FlexDSL MiniFlex

MINIFLEX DEVICES

TECHNICAL DESCRIPTION AND OPERATIONS MANUAL

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VERSION CONTROL

Manual Version	Date	Software Version	Major changes to previous version
1.0	16.03.2010	1.0.0	Initial Version
1.1	28.04.2010	1.0.0	DC-Power pinning changed
1.2	24.08.2010	1.1.5	Small change in Safety regulations
1.3	6.09.2010	1.1.5	Switch functions fully described
1.4	30.11.2010	1.1.5	DSL DINRail included
1.5	03.01.2011	1.3.4	RSTP in DSL Line card and DINRail added
1.6	29.08.2011	1.4.8	FOM Card integrated
1.7	21.10.2011	1.4.8	Software download corrected
1.8	30.12.2011	1.4.8	MiniRack added
1.9	03.12.2012	1.4.37	Alarm Command updated, LINKNM added, Commands adapted, MAC Filtering
1.10	26.03.2013	1.4.38	FOM2, PoE and Switch added
1.11	02.05.2013	1.4.38	Jumper Settings PoE changed
1.12	25.06.2013	1.4.38	Default IP address added, Port numbering, PoE Attention
1.13	22.10.2013	1.5.4	SSH & RADIUS added
1.14	05.05.2014	1.6.6	Table 3.15 corrected, Serial Interface Units added, SNMP& RADIUS updated, Commands updated incl. SD-Card

SAFETY REGULATIONS

IF THE UNIT IS NOT USED IN ACCORDANCE TO REGULATIONS DESCRIBED AND DEFINED IN THE CHAPTERS ”TECHNICAL DESCRIPTION” AND “TECHNICAL SPECIFICATIONS”, FLEXDSL TELECOMMUNICATIONS AG REFUSES TO TAKE ANY RESPONSIBILITY. FURTHERMORE, NO WARRANTY IS GRANTED IN SUCH CASE!

IT’S ONLY ALLOWED TO USE EXTERNAL POWER SUPPLYS THAT ARE APPROVED ACOORDING TO THE SAFETY STANDARD IEC/EN 60950-1.

THE DISCONNECTING DEVICE FOR THE RACK IS THE MAINS PLUG AND/OR THE APPLIANCE COUPLER. THE MAINS PLUG AND/OR THE APPLIANCE COUPLER HAS/HAVE TO BE EASILY ACCESSIBLE AND THE MAINS PLUG HAS TO BE NEXT TO THE RACK IF THE MAINS PLUG SERVES AS THE DISCONNECTING DEVICE.

IT’S ONLY ALLOWED TO USE THE UNITS WITH HOUSINGS SUPPLYED FROM FLEXDSL TELECOMMUNICATIONS AG (SUBRACKS, MINIRACK, UTTX). THE RACK HAS TO BE CONNECTED PERMANENTLY TO A RELIABLE PROTECTIVE ERTH CONDUCTOR. THE LTU UNIT AND LINECARDS HAVE TO BE FIXED TO THE RACK PERMANENTLY WITH THE TWO PANEL SCREWS.

INCORRECT USE OF THIS DEVICE, USE IN ANY OTHER ENVIRONMENT AND/OR HOUSING THAN PROVIDED BY FLEXDSL MIGHT LEAD TO HARMFUL CONDITIONS. FAILURE TO FOLLOW THESE PRECAUTIONS MAY RESULT IN DEATH, SEVERE INJURY OR PROPERTY DAMAGE.

Please read this manual carefully before operating the system.
Installation of this equipment has to be done by **qualified** personnel only.

EU DIRECTIVE 2002/96/EC AND EN50419

Our equipment is marked with the recycling symbol. It means that at the end of the life of the equipment you must dispose it separately at an appropriate collection point and not place it in the normal domestic unsorted waste stream. (European Union only)

1 SELECTION GUIDE

FlexDSL MiniFlex Models \ Functionality	19", 2U Subrack/Minirack	Backside Mountable	18-72 VDC	90-264 VAC, 47-63 Hz	Reduandancy Possibility	Ethernet 10/100BaseT	Gigabit Eth 1000Base-T	Gigabit Ethernet SFP	Point-to-Point	Point-to-Multipoint	Ring Applications	Spannung Tree	Link Aggregation	VLAN, QoS	Port Security	Multicast	Remote Power Receiver	Remote Power Source	Console Port Management	Telnet Management	Web Management	SNMP Management
MF-MR2N-SW-12Eth,V1	√		√		√	√	√	√	√	√	√	√	√	√	√	√			√	√	√	√
MF-MR2N,V1	√		√		√																	
MF-PS48, V1		√	√		√																	
MF-PS110/230, V1		√		√	√																	

FlexDSL MiniFlex Models \ Functionality	19", 2U Subrack/Minirack	2U Minirack, Rail or Wall	18-72 VDC	90-264 VAC, 47-63 Hz	Reduandancy Possibility	Ethernet 10/100BaseT	Gigabit Eth 1000Base-T	Gigabit Ethernet SFP	Point-to-Point	Point-to-Multipoint	Ring Applications	Spannung Tree	Link Aggregation	VLAN, QoS	Port Security	Multicast	Remote Power Receiver	Remote Power Source	Console Port Management	Telnet Management	Web Management	SNMP Management
MF-MR-RAIL-2U4S,V1		√	√		√																	

FlexDSL MiniFlex Line Cards \ Functionality	Standalone	Rail Mounting	MiniFlex Subrack Module	Protected Housing	Single Pair	Dual Pair Bonding	Dual Pair Standby		Point-to-Point	Point-to-Multipoint	E1 (120Ohm)	E1 (75Ohm) optional	Ethernet Bridge	Ethernet Add/Drop	RS-232/422/485 Interface	RS-232 Interface	Remote Power Receiver	Remote Power Source	Console Port Management	Telnet Management	Web Management	SNMP Management
MF-PAM-SR2L-2Eth,V1	√		√		√	√	√		√	√			√	√					√	√	√	√
MF-FOM-SRL,V1	√		√		√				√				√						√	√	√	√
MF-FOM-SR2L-2Eth,V1	√		√		√		√		√	√			√	√					√	√	√	√
MF-FOM-SR2L-SER/Eth,V1	√		√		√		√		√	√			√	√	√	√			√	√	√	√
MF-POE-SRL-2Eth,V1	√		√						√				√									
MF-SW-SRL-8Eth,V1	√		√						√	√			√	√					√	√	√	√
MF-SER-SRL-4V24,V1	√		√						√	√						√			√	√	√	√

Functionality / FlexDSL MiniFlex DINrail	Standalone	Rail Mounting	MiniFlex Subrack Module	Protected Housing	Single Pair	Dual Pair Bonding	Dual Pair Standby	Point-to-Point	Point-to-Multipoint	RS-232/422/485 Interface	RS-232 Interface	Ethernet Bridge	Ethernet Add/Drop	9-18 VDC	18-72 VDC	90-264 VAC, 47-63 Hz	Remote Power Receiver	Remote Power Source	Console Port Management	Telnet Management	Web Management	SNMP Management
MF-PAM-RAIL2N-2Eth-12V, V1	√	√			√	√	√	√	√			√	√	√					√	√	√	√
MF-PAM-RAIL2N-2Eth-24V, V1	√	√			√	√	√	√	√			√	√		√				√	√	√	√
MF-PAM-RAIL2N-2Eth-230V, V1	√	√			√	√	√	√	√			√	√			√			√	√	√	√
MF-FOM-RAILN-Eth-24V, V1	√	√			√			√				√			√				√	√	√	√
MF-FOM-RAILN-Eth-230V, V1	√	√			√			√				√				√			√	√	√	√
MF-FOM-RAIL2N-2Eth-24V, V1	√	√			√		√	√	√			√	√		√				√	√	√	√
MF-FOM-RAIL2N-2Eth-230V, V1	√	√			√		√	√	√			√	√			√			√	√	√	√
MF-POE-RAILN-Eth-24V, V1	√	√						√				√										
MF-SW-RAIL-4Eth-24V, V1	√	√						√	√			√	√		√				√	√	√	√
MF-SW-RAIL-4Eth-230V, V1	√	√						√	√			√	√			√			√	√	√	√
MF-FOM-RAIL2N-2V24-24V, V1	√	√			√		√	√	√		√	√	√		√				√	√	√	√
MF-FOM-RAIL2N-2V24-230V, V1	√	√			√		√	√	√		√	√	√			√			√	√	√	√
MF-FOM-RAIL2N-SER/Eth-24V, V1	√	√			√		√	√	√	√	√	√	√		√				√	√	√	√
MF-FOM-RAIL2N-SER/Eth-230V, V1	√	√			√		√	√	√	√	√	√	√			√			√	√	√	√

2 PRECAUTION

The present document describes devices of the MiniFlex family. The document contains the technical description of the devices, installation, configuration, and operation instructions. Appendices and installation manuals containing additional information about the system are also an integral part of the present document.

WARNING
BEFORE STARTING OPERATING THE EQUIPMENT, READ CAREFULLY THE CURRENT MANUAL AND THE INSTALLATION MANUAL. FLEXDSL TELECOMMUNICATIONS AG REFUSES NEITHER TAKING ANY RESPONSIBILITY NOR GRANTING ANY WARRANTY TO ANY DEVICE MALFUNCTIONING OR ANY DAMAGES DUE TO FAILURE TO COMPLY WITH THE REQUIREMENTS STATED IN THE MANUALS, ESPECIALLY IN THE SECTION RELATED TO “SERVICE INSTRUCTIONS”.

WARNING
IMPROPER USE OF OUR EQUIPMENT, USE IN ANY OTHER ENVIRONMENT OR IMPROPER INSTALLATION AND MAINTENANCE MIGHT LEAD TO HARMFUL CONDITIONS. FAILURE TO FOLLOW THESE PRECAUTIONS MAY RESULT IN DEATH; SEVERE INJURY OR PROPERTY DAMAGE.
FLEXDSL TELECOMMUNICATIONS AG REFUSES NEITHER TAKING ANY RESPONSIBILITY NOR GRANTING ANY WARRANTY IN SUCH CASE.

WARNING
ELECTRONIC MODULES CAN BE DAMAGED OR DECREASED IN RELIABILITY BY STATIC ELECTRICAL DISCHARGE. BEFORE HANDLING MODULES, WEAR AN ANTISTATIC DISCHARGE WRIST STRAP TO PREVENT DAMAGE TO ELECTRONIC COMPONENTS. PLACE MODULES IN ANTISTATIC PACKING MATERIAL WHEN TRANSPORTING OR STORING. WHEN WORKING ON MODULES, ALWAYS PLACE THEM ON AN APPROVED ANTISTATIC MAT THAT IS ELECTRICALLY GROUNDED. TO PREVENT ELECTRICAL SHOCK, DO NOT INSTALL EQUIPMENT IN A WET LOCATION OR DURING A LIGHTNING STORM.

WARNING
SOME MODULES CAN BE CONFIGURED TO HAVE REMOTE POWER. THIS MEANS, THAT THERE COULD BE A HIGH VOLTAGE ACCORDING TO EN 60950-1 SAFETY REGULATION. BE CAREFUL AND DO NOT TOUCH ANY COMPONENTS OF ANY MODULE. ALSO IN NOT POWERED STATUS, SOME CAPACITORS MAY STILL CARRY A HIGH VOLTAGE. PLEASE DO NOT TOUCH INSIDE OF ANY HOUSING (SUBRACK, MINIRACK, UTT1 OR UTT4).

3 TECHNICAL DESCRIPTION

3.1 General Information about FlexDSL MiniFlex

The FlexDSL **MiniFlex** platform is a special part of the **Orion3** product family. Beside of having up to 10 dual **Orion3 SHDSL.bis Extended** line cards there is a feature-rich managed layer 2 Ethernet switch included. This switch has 8 auto-sensing front accessible 10/100Base-T ports as well as 2 gigabit Ethernet ports with fiber connectivity (SFP) and 2 gigabit Ethernet ports with copper connectivity (RJ-45). The inside backplane connect this switch to all Orion3 line cards through additional 10 Ethernet 10/100 Base-T ports.
The FlexDSL Orion3 SHDSL.bis Extended product family offers a broad range of products, which are based on the latest SHDSL.bis standards (ITU-T G.991.2 & ETS TS 101 524), while also being fully interoperable with all our existing SHDSL equipment (Orion1 & Orion2). The FlexDSL Orion3 supports TC-PAM8/16/32 and the new TC-PAM64/128 line coding. The support of these line codes ensures compatibility with existing SHDSL equipment, that is already installed, in order to protect customer investments, while at the same time providing an upgrade path to the newest DSL technologies.
SHDSL.bis Extended allows symmetrical data transmission at speeds up to 15.2Mbps over a single pair of copper. In addition, the dual Orion3 line card also supports DSL channel bonding for 2 copper pairs in order to achieve speeds to 30.4Mbps! Using the link aggregation feature of the additional integrated switch, the FlexDSL MiniFlex can transmit up to 300Mbps over 20 copper pairs. This incredible speed makes Fiber installations in a lot of places needless.
Like all FlexDSL Orion products, the MiniFlex and his Orion3 SHDSL.bis Extended line cards are based on industrial components and are manufactured according to highest quality standards providing additional value due to the extended temperature range and higher reliability. The combination of comprehensive functions providing maximum flexibility together with the higher quality of the FlexDSL MiniFlex make it the perfect choice for your DSL needs.

The FlexDSL **MiniFlex** product family consists of

MiniFlex Subrack (Line Termination Units)

Usually Central Office Equipment.
Can be locally powered with DC and AC

MiniFlex MiniRack (Network Termination Units)

Both, Central Office and Customer Premise Equipment.
Can be locally powered with DC

NTU devices (Network Termination Units)

Usually Customer Premise Equipment.
NTU's can be powered from local DC power supply.
NTU's can be powered remotely.

RR devices (Repeater, Regenerator)

Increase (double) the distance.
RR's can be powered:

- locally with DC voltage.
- remotely.

Supported management features:

- Local Craft Terminal (USB), Telnet, SNMP and WEB
- Two levels of system users: administrator and user, protected with passwords

Supported operating modes:

- Point-to-Point, Point-to-Multipoint and Ring Applications

3.2 Description of MiniFlex Devices

The MiniFlex consists of the following devices:

- Subrack with integrated managed Ethernet switch and alarm/DC power frontaccess
- DC or AC power supplies (redundancy is possible)
- Minirack with integrated DC power supply
- Line card SHDSLbis extended or Fiber; Dinrail Modems

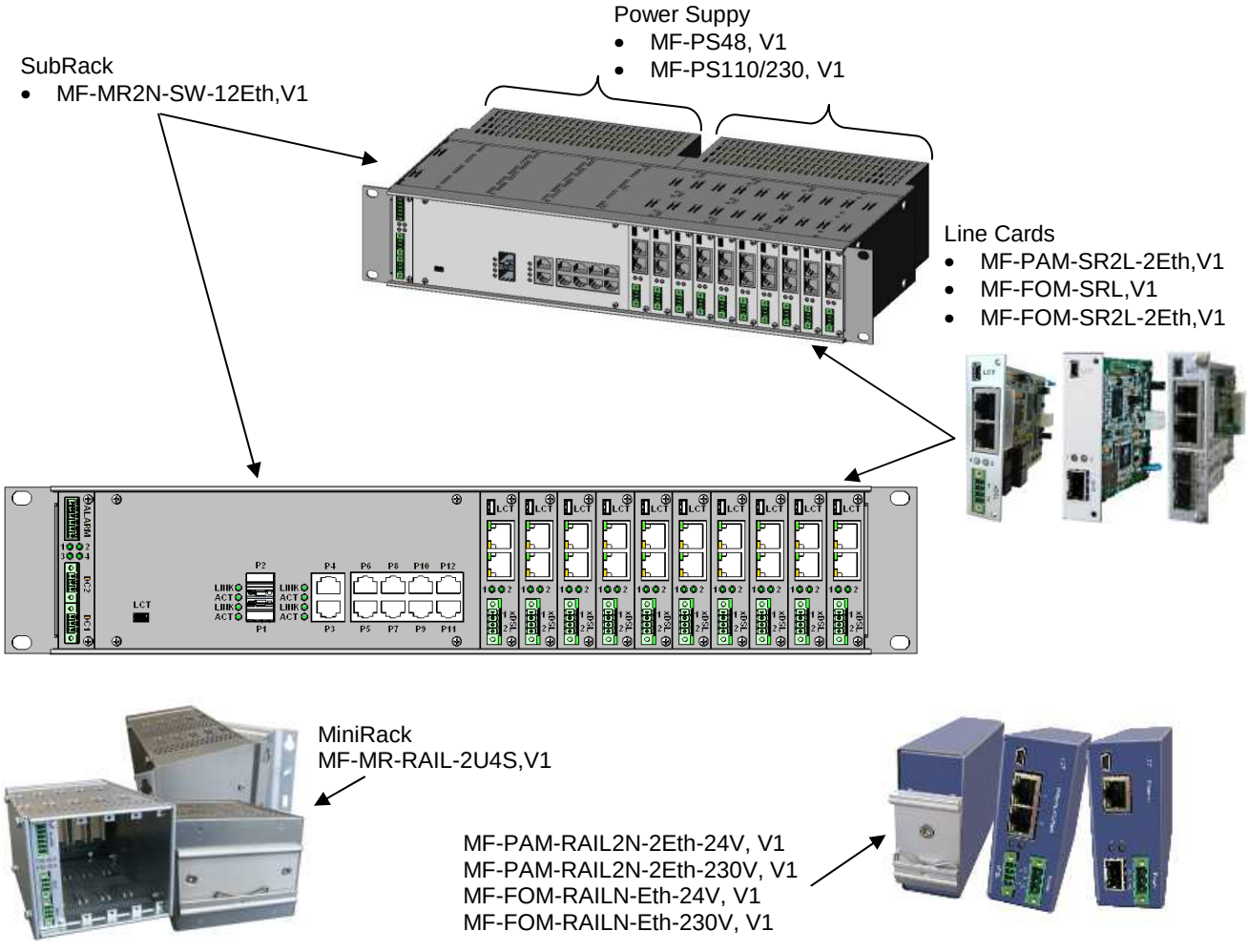


Figure 3.1 MiniFlex Devices

3.2.1 Subrack with Integrated Switch

The SubRack is designed for a 19“ rack and has a height of 2U (89mm). The is depth is180mm without any power supply and 248mm with the power supply equiped. All connections (except AC power!) are accessible in the front.

Beside the connection to two DC power supplies and the alarm relay outputs, there is an intergrated layer 2 managed Ethernet switch with the following main functionalities:

Spanning Tree and Ethernet Ring

- IEEE 802.1D Spanning TreeProtocol (STP)
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)
- Ethernet Ring Protection Mechanism, 50ms rapid ln switching and protection
- Port Mirroring, Jumbo Frames support (up to 9216 bytes)

VLAN

- 4K IEEE 802.1q VLANs, Port-based VLAN, MAC-Based VLAN, Private VLAN
- GVRP, Q-in-Q, VLAN Translation

Link Aggregation

- Static Trunk, Dynamic Trunk, IEEE 802.3ad LACP, Load Balancing

Multicast Features

- IGMP v1. v2, v3, IGMP Snooping, IGMP Groups, Multicast VLAN

Quality of Service (QoS)

- 8 Priority Queues/port, Bandwidth Control per Port
- WRR, Strict Priority, WDRR, WRR+Strict Priority
- 802.1p, Port-Based CoS, CoS based on MAC DA/SA

Access Control List

- MAC+Port Binding, VLAN+Port Binding

Port Security

- Trust Port, Port Blocking, Private VLAN, Port Powering Off
- MAC address learning limit per port, DoS check, Management IP list

Management

- Local Console Port (USB), Telnet/SSH, Web, SNMP v1 and V2c

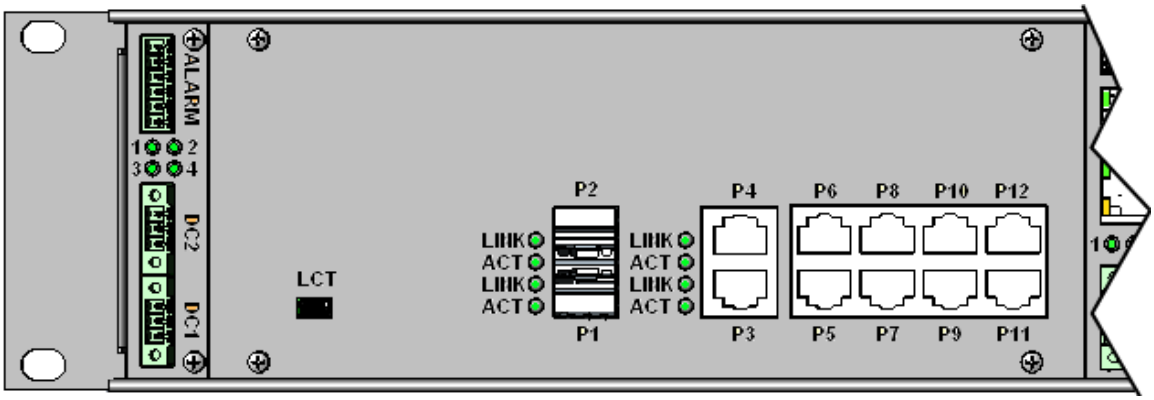
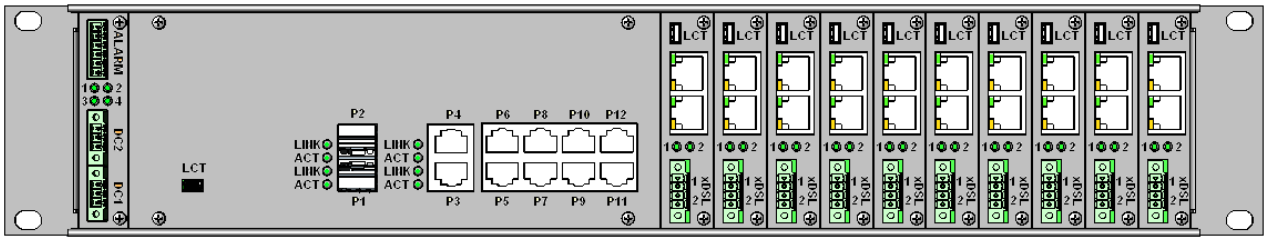


Figure 3.2 SubRack Frontplate

Element		Description	
ALARM		ALARM Connector with Urgent/NonUrgent Alarm (6-Pin Phoenix Mini Combicom MC 1,5/6-G-3,5)	
LED-1	LED-2	LED Red Urgent ALARM	LED Red NonUrgent ALARM
LED-3	LED-4	LED Green DC1 ok	LED Green DC2 ok
DC2		Power Supply Connector DC2 (3-Pin Phoenix Mini Combicom MC 1,5/3-GF-3,5)	
DC1		Power Supply Connector DC1 (3-Pin Phoenix Mini Combicom MC 1,5/3-GF-3,5)	
LCT		USB Connector Local Craft Terminal	
P1	P2	SFP Gigabit Ethernet Uplink Port 1	SFP Gigabit Ethernet Uplink Port 2
LINK	ACT	LED Green Link corresponding Port 1-4	LED Green Activity corresponding Port 1-4
P3	P4	RJ-45 Gigabit Ethernet Uplink Port 3	RJ-45 Gigabit Ethernet Uplink Port 4
P5	P6	RJ-45 10/100Mbps Ethernet Port 5 + two LED	RJ-45 10/100Mbps Ethernet Port 6 + two LED
P7	P8	RJ-45 10/100Mbps Ethernet Port 7 + two LED	RJ-45 10/100Mbps Ethernet Port 8 + two LED
P9	P10	RJ-45 10/100Mbps Ethernet Port 9 + two LED	RJ-45 10/100Mbps Ethernet Port 10 + two LED
P11	P12	RJ-45 10/100Mbps Ethernet Port 11 + two LED	RJ-45 10/100Mbps Ethernet Port 12 + two LED

Table 3.1 Connectors and LEDs on the front panel of SubRack MiniFlex.

Subrack Ethernet port numbering:



Port number:																				
	2	4	6	8	10	12	13	14	15	16	17	18	19	20	21	22
	1	3	5	7	9	11										

Figure 3.3 MiniFlex SubRack Ethernet Port numbering

Ethernet Port		Description	
P1	P2	Front: SFP Gigabit Ethernet Uplink	Front:SFP Gigabit Ethernet Uplink
P3	P4	Front:RJ-45 Gigabit Ethernet Uplink	Front: RJ-45 Gigabit Ethernet Uplink
P5	P6	Front: RJ-45 10/100Mbps Ethernet	Front: RJ-45 10/100Mbps Ethernet
P7	P8	Front: RJ-45 10/100Mbps Ethernet	Front: RJ-45 10/100Mbps Ethernet
P9	P10	Front: RJ-45 10/100Mbps Ethernet	Front: RJ-45 10/100Mbps Ethernet
P11	P12	Front: RJ-45 10/100Mbps Ethernet	Front: RJ-45 10/100Mbps Ethernet
P13	P14	Line Card 1: RJ-45 10/100Mbps Ethernet	Line Card 2: RJ-45 10/100Mbps Ethernet
P15	P16	Line Card 3: RJ-45 10/100Mbps Ethernet	Line Card 4: RJ-45 10/100Mbps Ethernet
P17	P18	Line Card 5: RJ-45 10/100Mbps Ethernet	Line Card 6: RJ-45 10/100Mbps Ethernet
P19	P20	Line Card 7: RJ-45 10/100Mbps Ethernet	Line Card 8: RJ-45 10/100Mbps Ethernet
P21	P22	Line Card 9: RJ-45 10/100Mbps Ethernet	Line Card 10: RJ-45 10/100Mbps Ethernet

Table 3.2 SubRack MiniFlex Ethernet Port Numbering.

3.2.2 Power Supplies for the Subrack

There are two different power supplies available. One is for DC input power and the other one is for AC input power. Each MiniFlex can use one or two power supplies depending on the need of redundancy.
The power connector for the DC power is on the front of the subrack and the connector for the AC power is on the back directly at the power supply.

3.2.3 MiniRack

The 5 slot MiniRack has a height of 2U (88mm) and a width of only 110mm. The is depth is181mm with power supply equiped. All connections are accessible in the front.
There are connectors available for to two DC power inputs and the alarm relay outputs (Power supply is in slot 1).

Figure 3.4 MiniRack Front- and Backside

Element		Description	
ALARM		ALARM Connector with Urgent/NonUrgent Alarm (6-Pin Phoenix Mini Combicom MC 1,5/6-G-3,5)	
LED-1	LED-2	LED Red Urgent ALARM	LED Red NonUrgent ALARM
LED-3	LED-4	LED Green DC1 ok	LED Green DC2 ok
DC2		Power Supply Connector DC2 (3-Pin Phoenix Mini Combicom MC 1,5/3-GF-3,5)	
DC1		Power Supply Connector DC1 (3-Pin Phoenix Mini Combicom MC 1,5/3-GF-3,5)	

Table 3.3 Connectors and LEDs on the front panel of MiniRack MiniFlex.

MiniRack Ethernet port numbering (when Switch is in slot 2, Line Cards in slot 3-5):

Port number:

1	5	6	7
2	8		
3			
4			

Figure 3.5 MiniFlex MiniRack Ethernet Port numbering

Ethernet Port		Description	
P1	P2	Switch Front: RJ-45 10/100Mbps Ethernet	Switch Front: RJ-45 10/100Mbps Ethernet
P3	P4	Switch Front: RJ-45 10/100Mbps Ethernet	Switch Front: RJ-45 10/100Mbps Ethernet
P5	P8	Line Card 1: RJ-45 10/100Mbps Ethernet	Line Card 1: POE-2, if PoE Line Card used
P6		Line Card 2: RJ-45 10/100Mbps Ethernet	
P7		Line Card 3: RJ-45 10/100Mbps Ethernet	

Table 3.4 SubRack MiniFlex Ethernet Port Numbering.

The backplane connections can be switched with a hidden Dip-Switch behind the dinrail clip. Please see in the following figure the standard backplane connections.

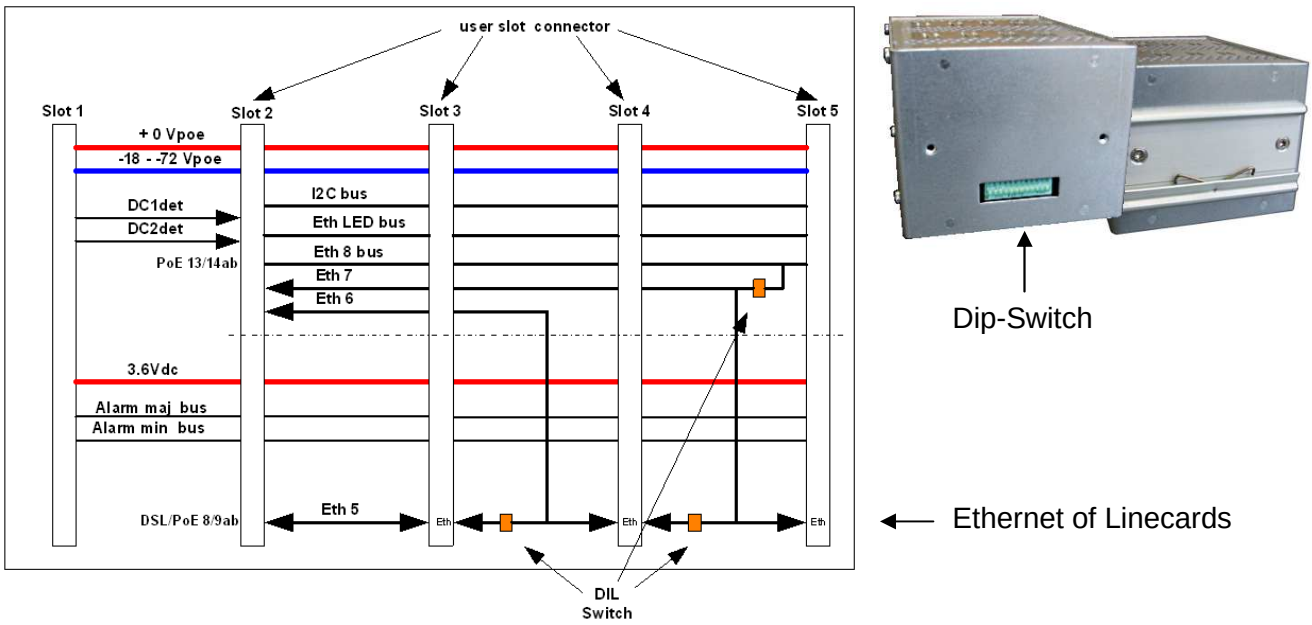


Figure 3.6 MiniRack backplane schematics

All backplane Ethernet interfaces of the available linecards (please see Eth5, Eth6, Eth7 on the schematics) are connected to slot 2. There is an Ethernet Switch Linecard available for slot 2. But the minirack can be used without the Ethernet Switch Linecard and the Ethernet interfaces can be connected as follows by the Dip-Switch:

Switch	Description
S1-S4 ON	Ethernet Slot5 (Eth7, P7) is connected to Ethernet Bus (Eth8 Bus, P8)
S5-S8 ON	Ethernet Slot4 (Eth6, P6) is connected to Ethernet Slot5 (Eth7, P7)
S9-S12 ON	Ethernet Slot3 (Eth5, P5) is connected to Ethernet Slot4 (Eth6, P6)

Table 3.5 Switch positions of MiniRack MiniFlex.

For the MiniFlex MiniRack unit there is a wallmount kit (MF-MR-RAIL-WALLMOUNT,V1) available.

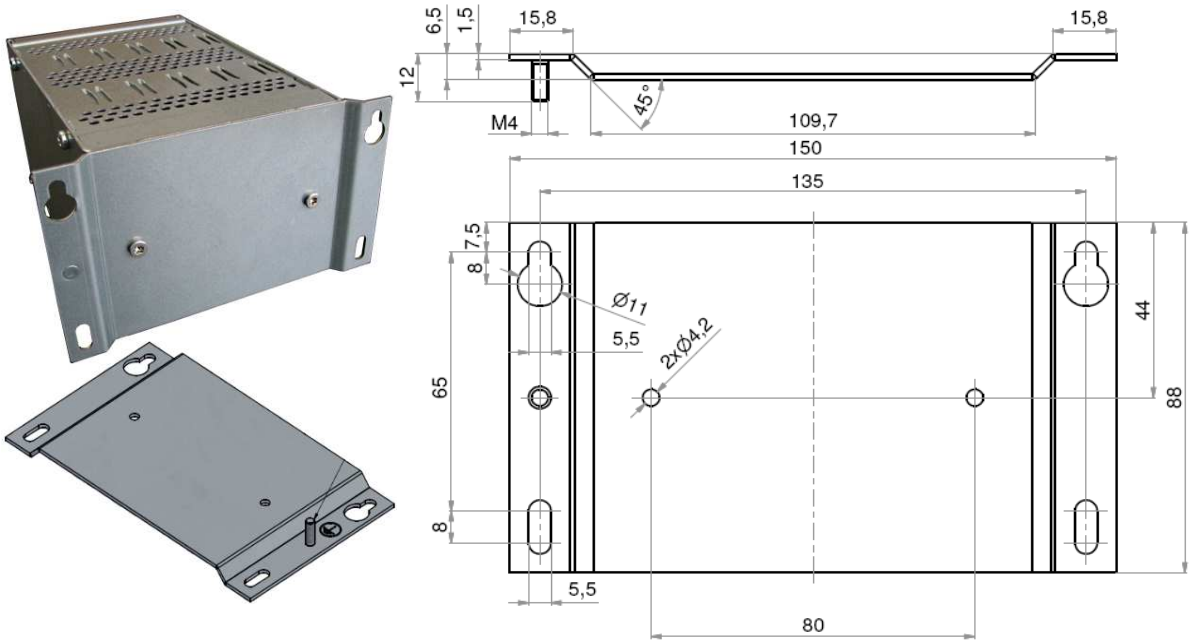


Figure 3.7 MiniRack Wallmount Kit

3.2.4 SHDSL Line Card

The SHDSL line card has two DSL lines with the possiblity for transmission speed up to 15.2Mbit/s per line. It means that one line card can transmit up 30.4Mbit/s with the pair bonding. There is also a local craft terminal on every line card to manage and configure if there is any ethernet failure of the main switch in the MiniFlex.
The two additional Ethernet interfaces on the front of the SHDSL line card can be used to manage the line card or to have an additional Ethernet interface to transmit data in every configured direction of the MiniFlex.

Figure 3.8 SHDSL Line Card

Element		Description	
LCT		USB Connector Local Craft Terminal	
		RJ-45 10/100Mbps Ethernet Port 1 + two LED	
		RJ-45 10/100Mbps Ethernet Port 2 + two LED	
LED-1	LED-2	LED Red/Green/Amber xDSL 1	LED Red/Green/Amber xDSL 2
xDSL 1/2		xDSL Connector 1/2 (4-Pin Phoenix Mini Combicom MC 1,5/4-GF-3,5)	

Table 3.6 Connectors and LEDs on the front panel of SHDSL Line Card.

3.2.4.1 Line Card SHDSL Interface

The SHDSL interfaces can operate fully independent of each other as well as they can be combined to operate in multipair mode. Therefore all independent SHDSL interfaces and groups of SHDSL interfaces (multipair mode) can be configured separately from each other. The multipair mode, the reservation mode and the automatic configuration detection mode naturally limit the independent working.
All SHDSL interfaces support plesiochronous data transmission. It means that reference clock frequencies, which are used to clock data transmission, are transmitted together with the data in different directions of one SHDSL link. The clock frequencies of different SHDSL channels are completely independent if they do not operate in the multipair mode.

Mode	Coding Type	Baserate	Standard	Transmission Data Rate
Master/Slave Fix Configuration	PAM16	3..60	Annex A, Annex B, Annex AB (autodetection)	Baserate* 64 kbit/s
	PAM32	12..89		
Master Autodetection	PAM16	Auto (3..60)	Annex AB (autodetection)	
	PAM32	Auto (12..89)		
Slave Autodetection	Auto (PAM16/32)	Auto (3..89)	Annex AB (autodetection)	

Table 3.7 Line settings per SHDSL interface, single pair, normal mode.

Mode	Coding Type	Baserate	Standard	Transmission Data Rate
Master/Slave Fix Configuration	PAM4	2..39	Annex A, Annex B, Annex AB (autodetection)	Baserate* 64 kbit/s
	PAM8	3..79		
	PAM16	1..119		
	PAM32	1..159		
	PAM64	2..199		
	PAM128	4..238		
Master Autodetection	PAM16	Auto (1..119)	Annex AB (autodetection)	
	PAM32	Auto (1..159)		
	PAM4/8/64/128	Not possible		
Slave Autodetection	Auto (PAM4/8/16/ 32/64/128)	Auto (1..238)	Annex AB (autodetection)	

Table 3.8 Line settings per SHDSL interface, single pair, extended mode.

3.2.4.1.1 Master/Slave

To establish a connection, it is necessary that one transceiver side is configured as Master and the other as Slave. In this case, the connection is controlled by the Master device.

3.2.4.1.2 Multipair Mode

If 2 SHDSL channels are configured to operate in the multipair mode, they work at the same clock frequency and line rate like one SHDSL channel with doubled transmission capacity. This transmission is also plesiochronous. In multipair mode, one SHDSL channel serves as a “master” channel, while the other SHDSL channel serves as “slave” channel. If the link in one channel fails, the links in the other channel break too and the procedure of connection/activation restarts. The main application for the multipair mode is the increasing of the transmission range. In this case, some channels operate at low transmission rates. In extended mode, multipair operation is not possible!

3.2.4.1.3 Automatic Link Configuration

The SHDSL line card supports to configure the complete link in accordance with the Master-Modem configuration. This mode is available for the following links:

- Point-to-Point single-channel or multipair links
- Point-to-Point multi-channel links with independent channels
- Star-topology multichannel links
- Links with regenerators

When the automatic configuration is used, the Slave-Modems and Regenerators receive nearly all configuration parameters for DSL through the link from the Master-Modem.
The system of automatic configuration operates the following way:

- The CP side (Slave) automatically adjusts configuration according to the stream structure received from the CO side (Master), not to cause permanent losses of user data.
- If the CP side (Slave) cannot adjust correspondingly, it displays a RCONF alarm and sends a message to the remote terminal device (Master). If configurations of terminal devices (Master and Slave) do not coincide, the RCONF alarm is displayed. RCONF means a remote urgent alarm.

The link is adjusted in the channel structure in the direction from the Master- to the Slave-Modem:

- The stream structure is configured on the Master-Modem device.
- If there is any Regenerator in the link, it receives this structure and configures itself according to it.
- Also a next Regenerator receives the structure from the previous Regenerator and performs configuration according to it.
- The Slave-Modem receives the stream structure from the last Regenerator in the link and also performs configuration
- When the Slave-Modem receives configuration, the Slave-Modem also receives the configurations of WAN. Therefore, the integrity of the Ethernet link is supported.

The RCONF alarm (displayed by the <ALARM> command) means that the local and remote equipment have incompatible configurations.

- The RCONF alarm is automatically not displayed if a DSL link, in which it was detected, fails.
- If the device operates in the CA mode (automatic configuration of a link), the alarm is not displayed when the device finally adjusts to the CO side (Master).

3.2.4.1.4 SHDSL Test Loop, Analogue Loop Back

The possibility to activate a test loop on SHDSL line interface simplifies the device start-and-adjustment.

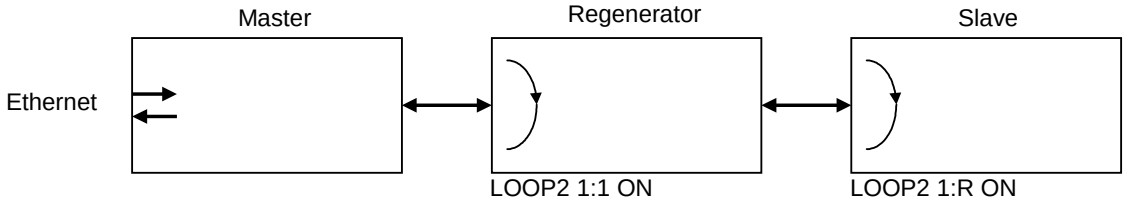


Figure 3.9. Test loops

Test loops can be activated for the Master and Slave devices as well as for the Regenerator.
LOOP2 M:N, where **M** is the number of the line interface and **N** is the number of the Regenerator, can be activated **only remotely**. This command allows activating remotely a loop back to the device, from which the command was sent. It means that if LOOP2 is activated remotely by the Master device, the data will be looped back by the Slave device to the Master device side, and vice versa.

WARNING
WHEN ACTIVATING LOOP2 UNDER CONDITIONS THAT SHDSL IS USED TO TRANSMIT ETHERNET DATA, IT IS NECESSARY THAT THE DEVICE IS DISCONNECTED FROM THE ETHERNET NETWORK!

Also an analogue loop back is possible. During the analogue loop back test, the SHDSL transceiver receives the transmitted signal from its own transmitter. The analogue loop back function (the **STARTAL** command is used to activate the analogue loop back) is used to test the equipment itself.
The analogue loop back causes a non-urgent alarm of the local unit and an urgent alarm of the remote unit.

WARNING
TO PERFORM THE ANALOG LOOPBACK, THE CABLE SHOULD BE DISCONNECTED FROM THE UNIT!

3.2.4.1.5 SHDSL Performance Monitoring (Noise Margin, G.826)

The transmission performance of a link can be monitored in two different ways. The signal quality is typically used during installation and maintenance procedures, whereas the G.826 error performance parameters are used for long term evaluation of operating links and during acceptance testing.
The Noise Margin (NM) provides qualitative performance information of a specific link. The **NM** command is used to activate this test. This parameter is calculated according to ITU-T G.991.2 and is an efficient tool for determining the qualitative performance of an SHDSL link.
During acceptance testing, it is recommended to set the line rate or choose cable pairs (at a fixed line rate) so that the NM value is no less that 6 dB.
An NM of 0dB in the presence of a Gaussian noise would yield an expected Bit-Error-Ratio of 10^{-7}.

The error performance monitoring of a SHDSL link is also performed according to ITU-T Rec. G.704. The evaluation of the G.826 error performance parameters is based on CRC (Cyclic Redundancy Check) error detection. CRC generation and detection are performed separately for the SHDSL interfaces.

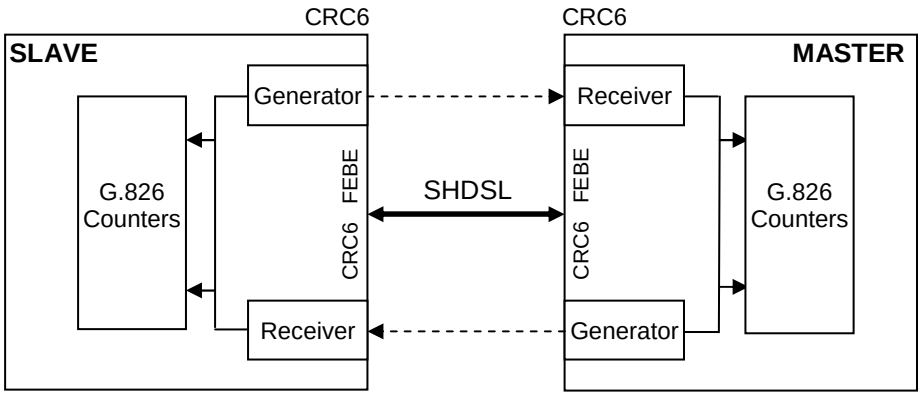


Figure 3.10 G.826 SHDSL performance evaluation

On the SHDSL side, six CRC6 check bits are generated per SHDSL frame. CRC6 errors are used by the software to count the block errors of the SHDSL channel and to evaluate its error performance according to ITU-T Rec. G.826.
The estimation of a bit error rate is not within the scope of G.826 calculations.

3.2.4.2 Line Card Ethernet Interface

The Ethernet interfaces of the SHDSL line card fulfil the standard IEEE 802.3 and support the Port (PBVLAN command) and Tag (VLAN command) based VLAN protocol (Virtual Local Area Network – IEEE 802.1Q). A virtual network represents a group of network nodes, whose traffic, including the broadcast traffic, is completely isolated from other network nodes. The organization of virtual networks usually decreases the load in the network, because the broadcast traffic will be transmitted not to the entire network but to members of the VLAN sender. Due to the fact that the members of different VLANs can exchange information via a router, which allows a controlled traffic, the use of VLAN technology provides a high level of security. In addition, any changes in the network structure are simplified because instead of configuring the work station to which the modem is connected you only have to configure the modem port.
To construct VLAN networks and to provide the priority in the data transmission, an extended Ethernet frame is used, which contains an additional VLAN tag of 2 bytes length. The tag includes the number of the VLAN to which the packet belongs and its priority level.
Some types of traffic (real-time video, voice or IP traffic) should be sent inside the network without any delays. To provide the necessary quality of this traffic, the SHDSL line card devices support Ethernet traffic priority according to the standard protocol IEEE 802.1P (so-called QoS, Quality of Service). It means to analyze the header content of each Ethernet frame to get information about the necessary priority of this application. The internal switch of the SHDSL line card places this data to the corresponding queue of the output port. The SHDSL line card equipment supports two priority queues when sending packets – a high and low priority queue. According to it, all Ethernet traffic can be divided into high priority groups (for example VoIP traffic or control and management channels) and low priority groups (for example LAN1 and LAN2).
The Ethernet traffic between all network interfaces of the device is distributed by the internal Ethernet switch. In the SHDSL line card devices three types of network interfaces exist:

- Ethernet interfaces (external connector on the front panel, and back plane connector)
- SHDSL interfaces (when the device is properly configured)
- Virtual management port (Telnet session)

The choice of the interface (DSL), which will be mapped to the corresponding WAN interface is performed by the <PAYLOAD> command.

A group of LANx Ports (Ethernet interface) means the LAN port connector on the front panel or backplane that can serve as a **Trunk port**, **Access port** or **Mixed port**.
The **Trunk port** is a port where all present packets have the VLAN format, namely, the Ethernet frame with a header, determining the number of the VLAN and QoS. In Trunk mode, only tagged frames pass into and out of LANx port, frames are allowed to pass on per-VLAN basis. This means that special equipment supporting VLAN is connected to the Trunk port. A PC with a standard network interface card cannot be connected to the Trunk port.
The **Access port** is a port where all present packets have a standard Ethernet format (without the additional two bytes for the header). It means that only untagged frames pass into (ingress) and out of (egress) any LANx port. On ingress, frames are assigned with a default VLAN tag (configured by VID and QoS commands). On egress, only frames with VLAN equal to the default VLAN of the port are allowed, and this tag is removed. A PC with a standard network interface card can be connected to the Access port.
The **Mixed port** is a port where tagged and untagged traffic is allowed. However, on ingress, a default VLAN tag is assigned to untagged traffic (configured by QOS and VLAN commands), so that all frames in the system are actually tagged. On egress frames with VLAN equal to the default VLAN (configured with VLAN command), exit the port untagged, while to all other VLANs apply pass/block rules set by the ALLOW command.

Mode	Default VLAN (set with VLAN command)	VLAN1-VLAN8, OTHER (set with ALLOW command)
ACCESS	Untagged traffic outside of the modem. VLAN tag is added on ingress, removed on egress.	Not taken into account
TRUNK	Not taken into account	Tagged traffic outside of the modem. VLAN tag is not modified on egress and ingress.
MIXED	Untagged traffic outside of the modem. VLAN tag is added on ingress, removed on egress.	Tagged traffic outside of the modem for VLANs not equal to default VLAN. VLAN tag is not modified on egress and ingress.

Table 3.9 Access, Trunk and Mixed Mode

SHDSL line card devices always transmit Ethernet packets over DSL or E1 interfaces with the VLAN format. It means that data packets coming from Access ports are first transformed into Ethernet packets with VLAN format (adding standard VLAN number and QoS priority level) and after this transmitted over any line interface.

There is a special case when having the same MAC address on different VLANs and PBVLANs. Normally, there should not be two devices on the network sharing the same VLAN. But IEEE 802.1Q VLANs as well as port-based VLANs allow creating separate logical networks on one physical network. Thus, in different VLANs or PBVLANs there could be devices sharing the same MAC address. On SHDSL line cards, however, there is a hardware limitation preventing all VLAN+PBVLAN combinations from having different address databases, and therefore, allowing same MAC address to be used on all VLAN&PBVLAN combinations is possible in the modem configuration. But, knowing which configurations are valid will allow using modems in all really vital configurations. There are two rules.

1. For separately managed VLANs 1-8. Each VLAN has its own MAC address table, and thus device with MAC address ABC in each of these 8 VLANs will not conflict with any device with MAC address ABC in any other VLAN. But the limitation here is the use of port-based VLANs. MAC address database is shared among all PBVLANs for VLAN1-8. Therefore a device with MAC address XYZ, VLAN1, PBVLAN A, will conflict with device with MAC address XYZ, VLAN1, PBVLAN B.
2. For all other VLANs. Here, every PBVLAN has its own MAC address table, but different VLANs on one PBVLAN share the same database. A device with the MAC address XYZ, VLAN(any other), PBVLAN A, will not conflict with a device having the MAC address XYZ, VLAN(any other), PBVLAN B. But the device with the MAC address ABC, VLAN(any other), PBVLAN A, will conflict with the device having the MAC address ABC, VLAN(any other+1), PBVLAN A.

Same MAC address	VLAN1, VID=1 PBVLAN A	VLAN other, VID=100 PBVLAN A	VLAN other, VID=200 PBVLAN A	VLAN1, VID=1 PBVLAN B	VLAN other, VID=100 PBVLAN B	VLAN other, VID=200 PBVLAN B
VLAN1, VID=1 PBVLAN A	N/A	OK	OK	NOK Same MAC on same VLAN for VLAN=1..8	OK	OK
VLAN other, VID=100 PBVLAN A		N/A	NOK Same MAC on same PBVLAN for VLAN≠1..8	OK	OK	OK
VLAN other, VID=200 PBVLAN A			N/A	OK	OK	OK
VLAN1,VID=1 PBVLAN B				N/A	OK	OK
VLAN other, VID=100 PBVLAN B					N/A	NOK Same MAC on same PBVLAN for VLAN≠1..8
VLAN other, VID=200 PBVLAN B						N/A

Table 3.10 Same MAC address on different VLANs and PBVLANs

In addition, every unit has a table of static MAC addresses (up to 8 addresses) for connected devices, so that each device can have a VLAN number and a QoS priority level (this is a table of special MAC addresses). If a packet is received from the Access port and the MAC address of the packet sender is inside this table, a header with the necessary VLAN number and the QoS priority will be assigned to this packet before transmitting it to the Trunk port. Otherwise, a default VLAN number and QoS priority will be assigned to the packet.

A group of DSL ports (WAN1–WAN2) (SHDSL interface) means that Ethernet data can be mapped onto specified timeslots (64kbit/s) on the SHDSL interface by using the internal switch. In this case, this port always serves as a **Trunk port**. Any data received from **Access/Mixed ports** are first transformed into Ethernet packets with VLAN format and then transmitted over the SHDSL interface.

A virtual management port (INT) (Virtual management port) is an internal device management program. The IP-address of this device is the logical address of the management program. For example, to open a session for managing a remote device, the IP-address of this device should be specified in the Telnet program. At the physical layer, the MAC address of the device is also the management program address, which is inside the Ethernet frame.

Note: As a rule the data of the management port have the highest priority (example, QoS = 7).

3.2.4.3 Line Card MAC Filter

The system supports MAC filtering feature. If enabled the device will filter MAC addresses and acts according to the defined MAC filtering rule. If disabled, the system will store and forward correct Ethernet packets according to the configuration of Ethernet subsystem.

White List

White List contains a list of MAC addresses. The fact of MAC address presence in the list means that the data exchange between the modem device and the node with selected MAC is allowed.

The data exchange between the modem device and the node with non listed MAC address is prohibited.

Interfaces

The White List is applicable per LAN Interface. Therefore the number of lists is equal to the number of physical Ethernet ports of the device.

Note: White List can't be enabled on WAN interfaces.

Number of Entries
Every White List stores up to 10 MAC addresses. A same MAC address can be stored in several White Lists.

3.2.4.3.1 Line Card MAC Filter Rules

MAC Address Filtering
If ingress packet has a MAC address that is not listed in the White List the LAN interface belongs to, this packet will be dropped. No information will be recorded and no message will be generated by the device. It is default mode and it will be enabled automatically as soon as the MAC filtering feature will be enabled.

MAC Address Filtering and Intruder Alarm
It is possible to enable Intruder Alarm indication on the device. If enabled, the SNMP Trap will be generated by the device if the unlisted MAC will arrive to the port. The Trap from the same non-listed MAC address will be generated approximately once in 3 minutes. Trap contains the information about the Intruder MAC address.

Port Blocking and Intruder Alarm
It is possible to enable Port Blocking Mode in case if unlisted MAC has been arrived. Upon receiving the wrong MAC the Port will go to Down State equal to ETHSD OFF X command where X is an interface number. The Intruder Alarm Trap and Link Down Traps will be generated in this case.

NOTE: Port will keep the blocked Down State even after reset of the device. To restore port operation the command ETHSD 10H/10F/100H/100F/AUTO X or WEB GUI shall be used.

3.2.4.4 Line Card Rapid Spanning Tree Protocol

The line card supports Rapid Spanning Tree Protocol (RSTP) according to IEEE 801.1d 2004 recommendation. All available Ethernet ports as well as all available WAN interfaces could participate in RSTP construction. A WAN interface could be configured to carry Ethernet data over DSL line. If several DSL links are combined into MULTIWAN, this MWAN will participate in RSTP construction too.

The RSTP itself is a protocol used for dynamic link switching in networks with ring topology. The ring topology improves reliability of data networks; nevertheless Ethernet networks must have only one active path between any of two nodes to prevent packet loop. Ethernet switches with enabled RSTP detect paths availability in a ring and quickly select active path, discarding other paths. All RSTP-enabled devices exchange information about topology change in so-called BPDU packets.

Root Bridge
One switch in a RSTP-enabled network must acts as Root Bridge. Root Bridge selection will be done automatically according to Bridge ID – a unique ID that each member of RSTP network has. Bridge ID is a combination of Switch MAC address and Bridge Priority. Switch with smallest Bridge Priority will act as Root Bridge. If two or more switches have same priority, Switch with less MAC address will become Root Bridge.

Port Roles
After Root Bridge has been selected, other switches define their ports role. The port that has the shortest path to Root Bridge will become Root Port. The opposite port on the other switch will

become Designated Port. The Root Bridge has Designated Ports only, while other switches have one Root port and could have Designated Port connected to other switches

A Root and Designated ports are active, they learn and forward packets. Other ports have blocking state. They could act as Alternate port or as Backup port. Please take a look to a picture below:

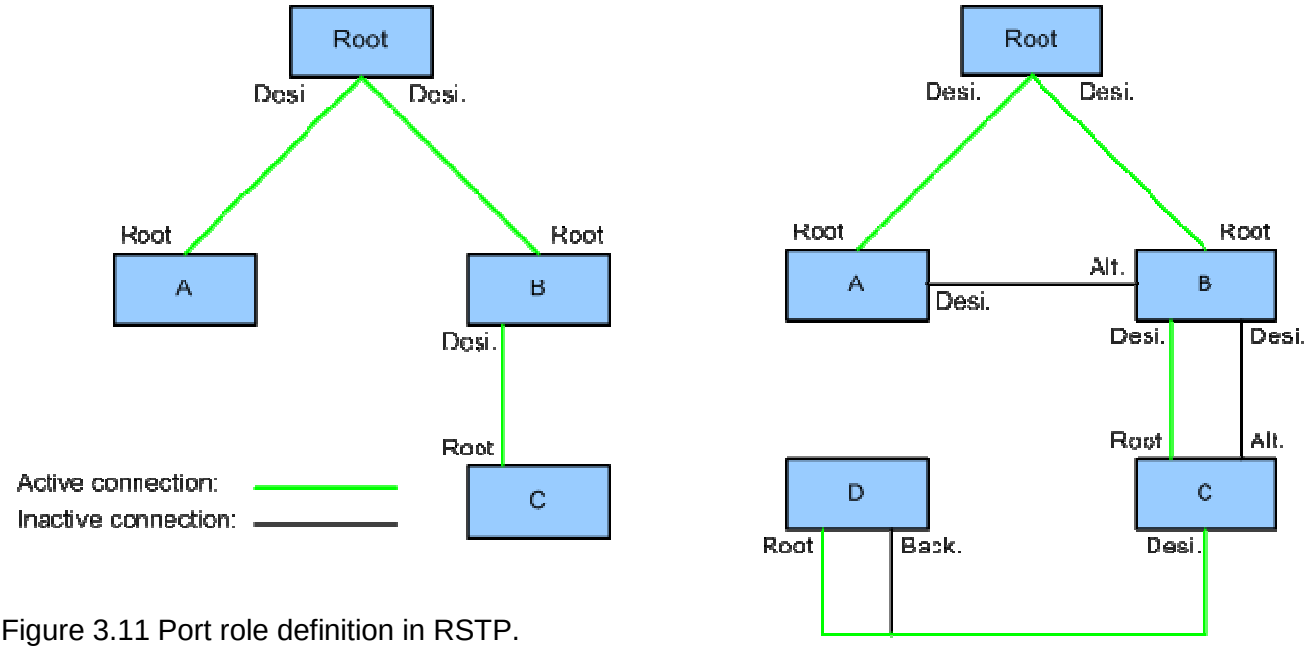


Figure 3.11 Port role definition in RSTP.

When a failure appears on a network, an alternative path will be selected and port roles will be changed. Please take a look to a picture below:

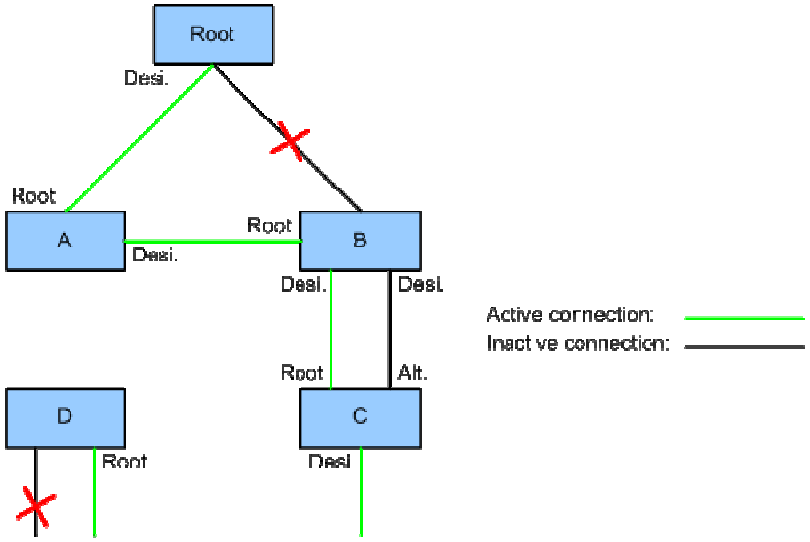


Figure 3.12 Change of Port role upon network failure.

ONLY PORTS WITH ROOT AND DESIGNATED ROLES WILL FORWARD DATA PACKETS. PORTS WITH ALTERNATIVE ROLE WILL BE IN BLOCKED STATE

3.2.4.5 Line Card Alarm and LED Description

When managing the SHDSL line card via the local craft terminal (USB) or via Telnet, all LEDs, except the Ethernet LEDs will blink with a frequency of 1 Hz.

The LEDs display the normal operation conditions and the alarm conditions of each line card and of each interface according to the following tables. To display an urgent alarm has always the highest priority and will overwrite a non-urgent alarm.

Element	Description
Two LED on RJ-45	Status 1st Ethernet Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 2nd Ethernet Interface Led1=Green, Led2=Amber
LED 1	Status 1st SHDSL Interface
LED 2	Status 2nd SHDSL Interface

Led Color		
Status Ethernet Interface		
Connection is active	Led1	Green
Connection is not active	Led1	Off
Data receive and/or transmit	Led1	Green Blinking
100 Mbit/s receive/transmit rate	Led2	Amber
10 Mbit/s receive/transmit rate	Led2	Off
Status SHDSL Interface		
Power failure or power is off		Off
Hardware or software failure		Red Blinking
Normal operation		Green
Non urgent alarm		Amber
Urgent alarm		Red

Table 3.11 SHDSL line card LED behaviour according to the interface status.

Name	Group	Alarm status	LED 1/2 Status SHDSL	Description
LOS	DSL	Urgent	Red	Loss of signal in an SHDSL link
LOSW			Red	Loss of frame alignment in an SHDSL link
LOSD			Red	Loss of signal at the remote SHDSL side
BER-H			Red	Block-error-rate in an SHDSL line according to G.826 ≥ 30%
SEGD			Red	Loss of signal or an alarm on a regeneration segment (segment degradation)
ALB		Urgent & Non-urgent	Amber	SHDSL analogue loop back is activated
SEGA		Non-urgent	Amber	Data errors or loss of frame alignment on a regeneration segment (segment alarm)
NM			Amber	Noise Margin < setup NMTHR value
LA			Amber	Line Attenuation > setup LATHR value
LOOP2			Amber	Loop is activated from the remote device to the local device

RCONF			Red	Configuration of the remote device is not compatible with the configuration of the local device
HW-F	Maintenance		Red Blinking	Hardware failure
DSL-F			Red Blinking	DSL signal processor initialization failure

Table 3.12 Alarm correspondance to LED behaviour

3.2.4.6 Line Card Management with Local Craft Terminal and Ethernet

Every SHDSL line card has some integrated management and diagnostic functionality, that can be used to configure the devices and to receive additional information like G.826 parameters or any G.SHDSL link quality.The access to this functionality is done by:

- Connecting the local craft terminal (LCT, USB interface) to any management terminal (PC with VT100 terminal, for example the application Hyper-Terminal).
- Connecting the local Ethernet interface to any management terminal (PC with Ethernet network card). In this case you access with a Telnet session or you use the WEB interface to display some statistics. Also the SNMP (Simple Network Management Protocol) is integrated.
- Connecting the backplane Ethernet interface to access the unit through the integrated Switch.

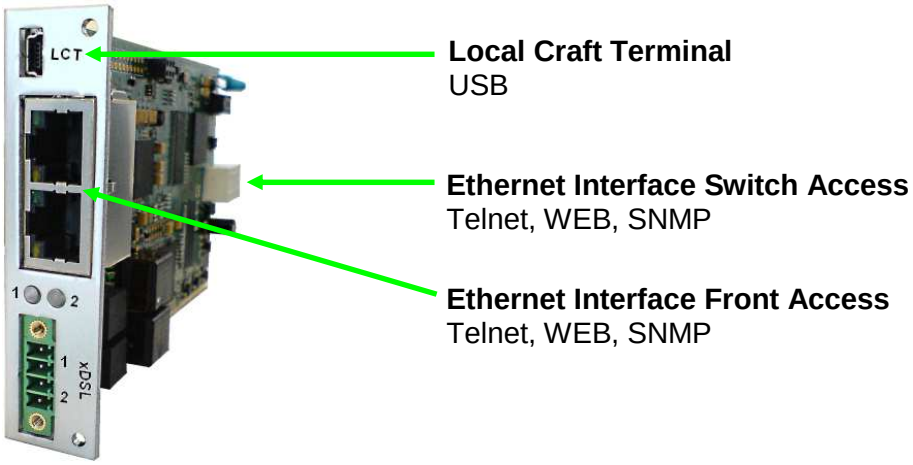


Figure 3.13 SHDSL Line Card showing Local Craft Terminal and Ethernet Interface

To use the USB interface as local craft terminal, you need to download and install the following driver http://www.flexdsl.ch/extranetfiles/Software/Orion3_USB_Driver.zip. This is an USB to serial driver and allow to have a COM port over USB.

3.2.4.6.1 Telnet (Ethernet Interface)

The **TELNET** (TELecommunication NETwork) access is made through the Ethernet network. With any computer and a program with the Telnet protocol SHDSL line cards can be fully managed. After opening the Telnet session, there is a user authentication: “admin” users, who can change configurations and “user” users who can only view parameters and statistics. Initially passwords are empty. In this case the authentication is not performed and users automatically have the administrator rights. Only “admin” users can set passwords for both types of users. If authentication is successful, the modem main menu is displayed. If authentication fails, it can be repeated up to three times, and after it the connection breaks.

Example: The management through a Telnet session can be activated by a standard command on any Windows computer: **telnet <IP-address>**
If no symbols are received by the modem over the telnet connection within 5 minutes, this session breaks. And with correct configuration, every SHDSL line card with an IP address can be reached; it does not matter if near end, far end or repeater.

3.2.4.6.2 WEB (Ethernet Interface)

The WEB interface is used to display statistics and do configuration when the SHDSL line cards are connected to the management computer via any Ethernet interface. Any WEB browser can be used to access the WEB interface. To display the statistics you should enter the command: **http://X.X.X.X** on the WEB browser. (X.X.X.X is the IP-address of the modem). After the connection is established, the active window of the WEB browser displays the following alarms and statistics (there are several pages available):

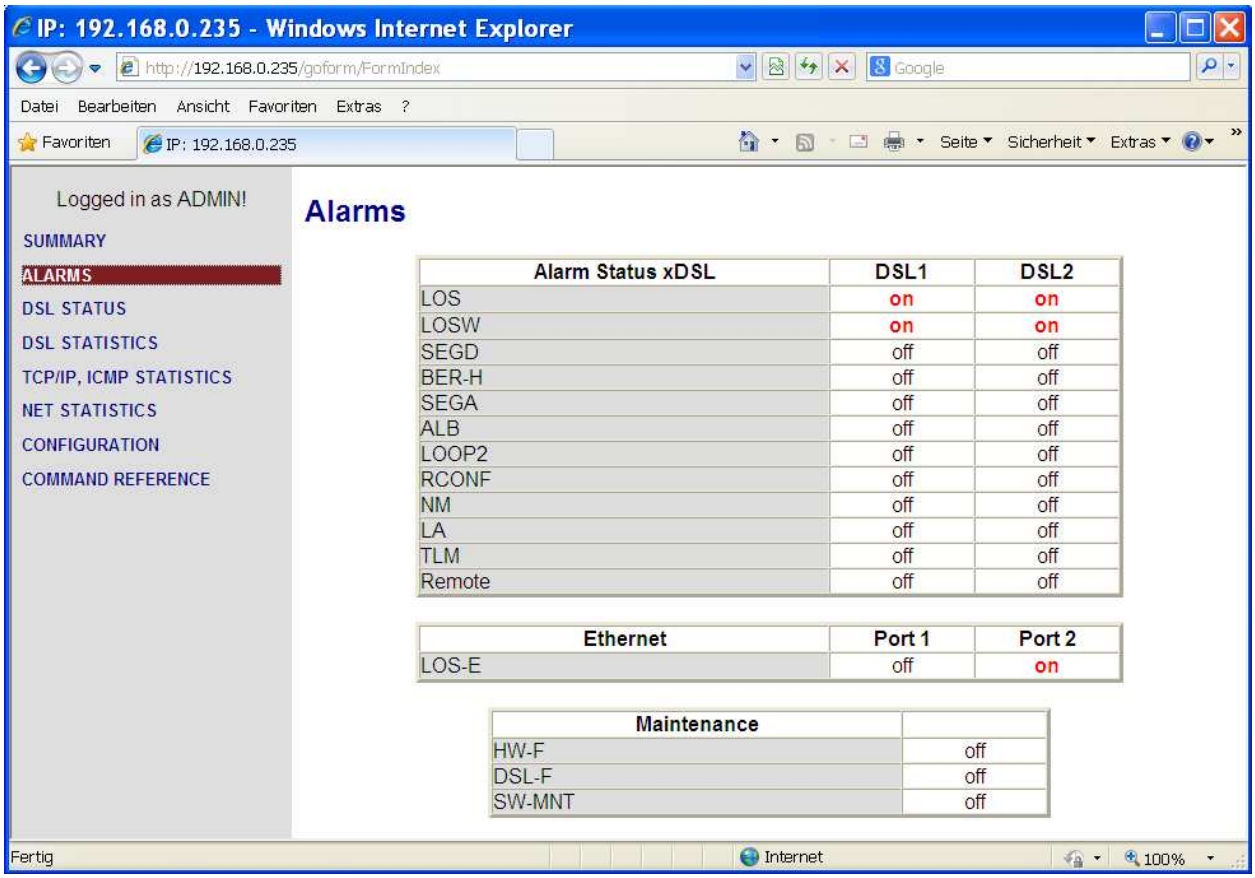


Figure 3.14 WEB interface – “SHDSL Line Card Alarms”

If you chose the configuration menu you have some tabs for the configuration. Please check under the command description if you need some explanation about any setting. If you have changed the configuration you have to press the “Save” button. The configuration is then active and if you like to have the configuration stored you have to change to the tab “Device Management” and press the “Confirm” button.

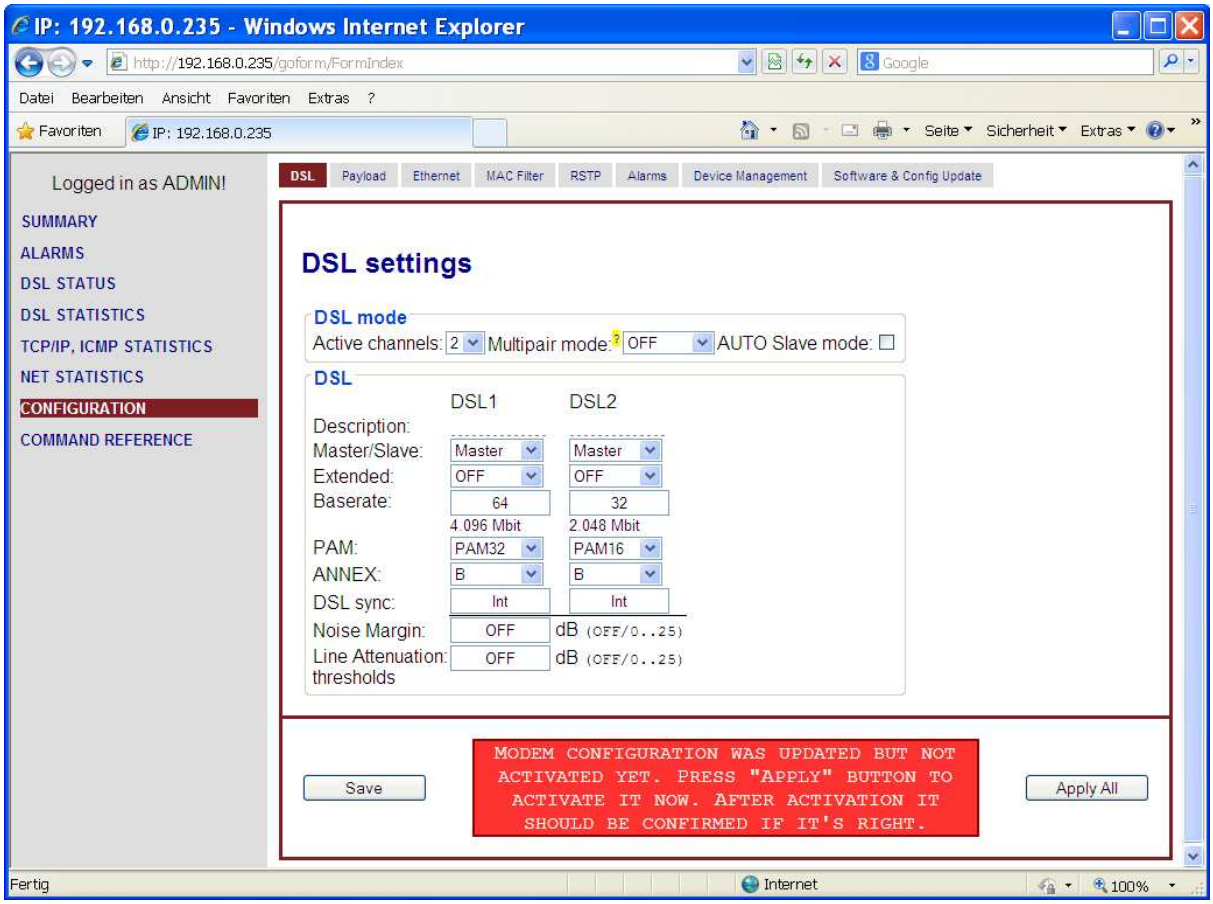


Figure 3.15 WEB interface – “SHDSL Line Card Configuration”

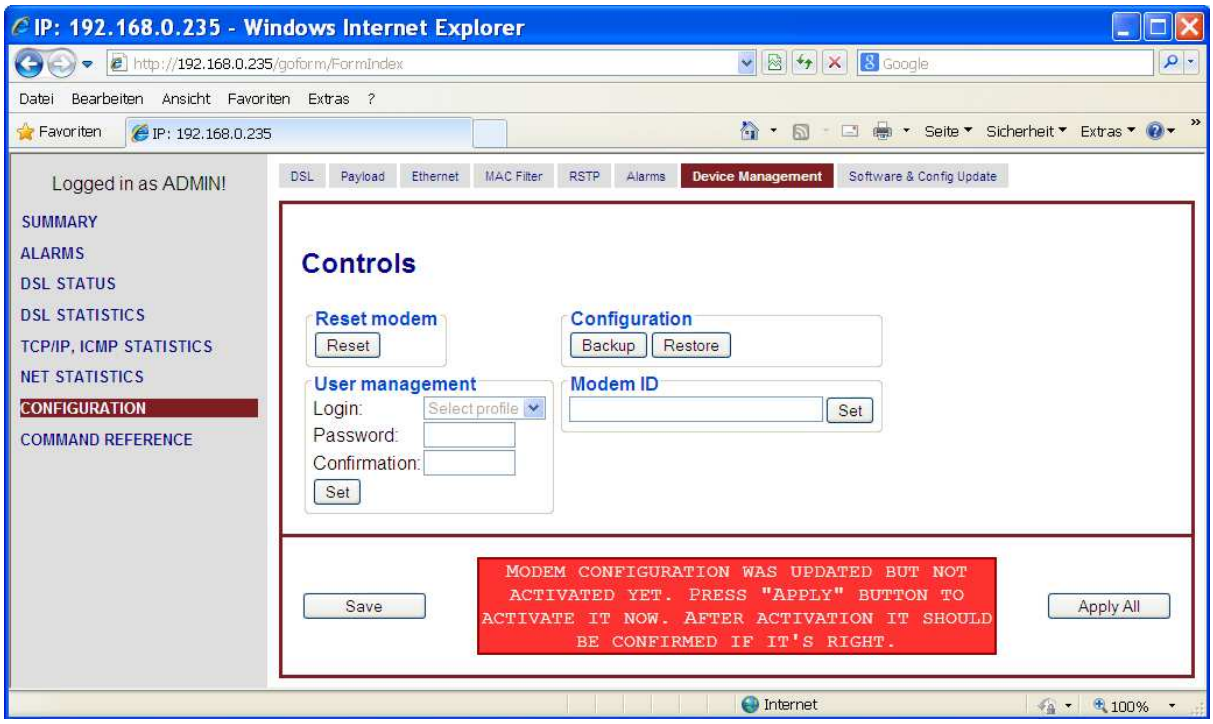


Figure 3.16 WEB interface – “Device Management”

All tables are displayed dynamically. The parameters in the tables are refreshed every 5 seconds. Click the button in the left part of the window of the WEB browser to display the necessary table. The software version is also displayed in the left part of the window. The WEB

interface of the SHDSL line card has following windows: Alarms, DSL Status, DSL Statistics (G.826), TCP/IP & ICMP Statistics, Net (WAN) Statistics, Command Reference.

3.2.4.6.3 SNMP (Ethernet Interface)

The SNMP (Simple Network Management Protocol) is used to monitor the status and to manage network devices. Unlike other management protocols such as Telnet, SSH and HTTP, the SNMP protocol not only allows an operator to manage the unit, but also informs him about the changes in the device status when management session was inactive.
The SNMP protocol has a client-server background. The modems act as SNMP-Agents, they communicate with the SNMP-Server that is actually a software and available free or commercially from various vendors for different platforms. The FlexView Network Management System (NMS) from FlexDSL Telecommunications AG is available too.

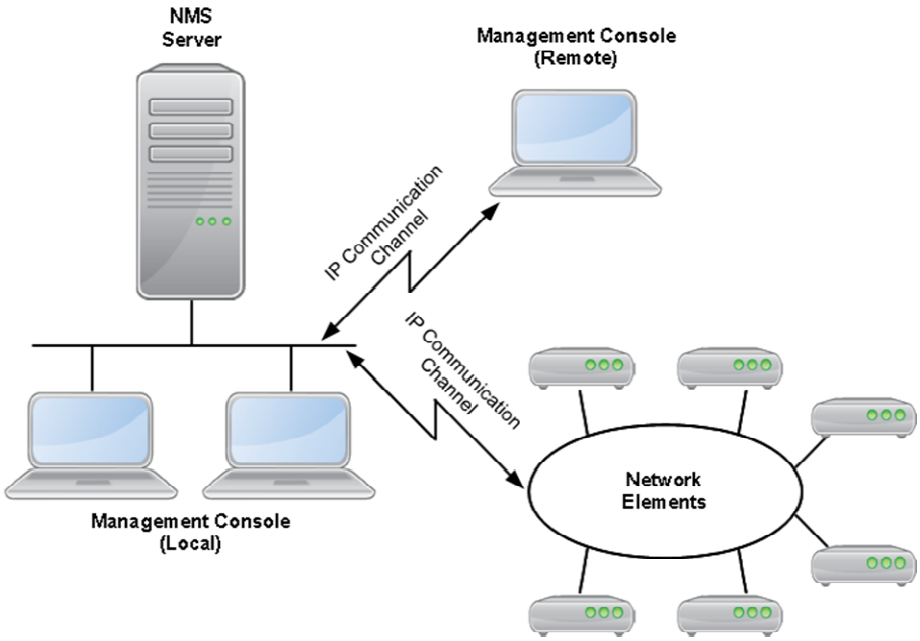


Figure 3.1. The structure of SNMP-based NMS.

The NMS Server authenticates local and remote Management Consoles, interact with other NMS Servers, sends and receives SNMP messages and stores various databases including the MIB database. The Management Information Base (MIB) is a plain text file that has to be imported into the SNMP Server for the purpose of translation the Object Identification (OID) numbers and their content to the human readable format. For example, it is requested to check the status of LAN port. The network administrator can check the SNMP variable with the OID 1.3.6.1.2.2.1.2.2.1.8 path, or, if using MIB file, the same variable can be reachable at the RFC1213-MIB|ifOperStatus address. Its content can be "2" in the first example, or "down" if MIB file is used.

The following MIB files are supported:

- MIB II RFC1213-MIB, a standard MIB for all devices is fully supported
- IF-MIB, RFC-2863, MIB descriptions of interfaces is fully supported
- NATEKS-MIB, MIB for the Nateks/FlexDSL equipment is fully supported
- DS1-MIB, RFC-2495, MIB describing E1 streams is partially supported
- RMON-MIB, RFC-2819 remote monitoring for statistics is fully supported
- RS-232-MIB, RFC-1659 for serial interfaces is partially supported
- BRIDGE-MIB, RFC-4188, a standard MIB for Ethernet Bridges is fully supported
- Q-BRIDGE-MIB, RFC-4363, an extended MIB for Ethernet Bridges is partially supported
- RSTP-MIB, RFC-4318, an extended MIB for RSTP protocol is fully supported

Local and Remote Management Console are intended for the graphical representation of network map, device icons and device views. It accepts the user actions such as mouse clicks, zooming, key pressings, etc. The Management Console interacts with the SNMP Server via the Remote Procedure Call (RPC) data in TCP/IP envelope. The Management Console can coexist with the SNMP-Server on the same PC or work on a separate computer.
Network Elements are copper and fiber modems, converters and other network devices. Network Elements support the following versions of SNMP protocol:

- V1, is initial version of SNMP protocol
- V2c, is the updated version of SNMP protocol featured bulk requests and long counters
- V3, is the latest version featured authentication and message encryption. Two users are actually supported.

Depending on the SNMP protocol version, the following SNMP messages are supported:

- for the SNMP V1: GET, GET NEXT, SET, TRAP
- for the SNMP V2c: GET, GET NEXT, GET BULK, SET, TRAP
- for the SNMP V3: READ, WRITE, TRAP

GET and READ messages initialized by the SNMP Server and intended for getting information from the Network Element.
SET or WRITE message initialized by the SNMP Server and intended for changing the SNMP variable of the Network Element.
TRAP messages initiated by the Network Element. These messages carry information about status change of the Network Element. For example, if port goes Down or Up, if the device have been restarted, or if the alarm appeared, the TRAP message will be send to the direction of the SNMP Server. Two destinations are supported for TRAP messages.

The following TRAP messages are supported:

- cold Start (RFC-1215)
- authentication Failure (RFC-1215)
- linkUp (RFC-1213-MIB, IF-MIB)
- linkDown (RFC-1213-MIB, IF-MIB)
- dsx1LineStatusChange (DS1-MIB)
- device specific traps (nateks.mib)
- newRoot and topologyChange (RFC-4188, BRIDGE-MIB)
- RMON Event (RMON-MIB)

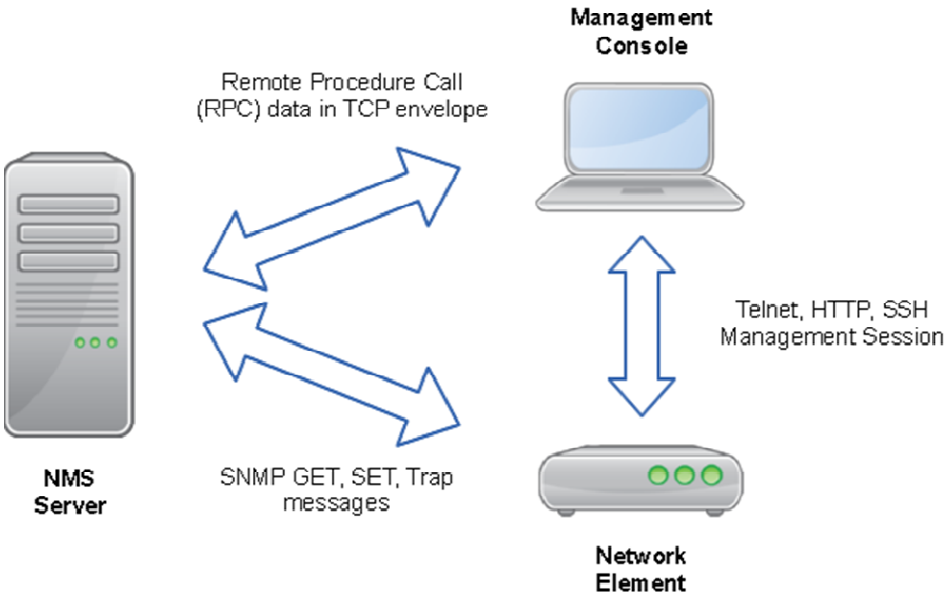

Management Console
Remote Procedure Call (RPC) data in TCP envelope
Telnet, HTTP, SSH Management Session
NMS Server
SNMP GET, SET, Trap messages
Network Element

Figure 3.2. Message exchange in SNMP-based networks.

NOTE: The NMS Server is not involved into the message exchange for management protocols such as Telnet, SSH and HTTP. These sessions are initiated between Management Console and Network Element directly.

3.2.4.6.4 SSH

The SSH (Secure SHell) protocol is used to access MiniFlex devices over IP networks. Unlike Telnet, the SSH packets are encrypted with a key and can't be read if intercepted by an intruder. Therefore User data such as login and password credentials can be safely transmitted over public networks.
The MiniFlex modem acts as SSH server. It listens default TCP Port 22 for incoming connections from remote clients and initialises Login/Password sequence if connection appears. Default Port 22 can be changed for the security reasons.
User will have an access to the CLI after successful login.
The SSH client is a software for PC. We suggest to use PuTTY for the Microsoft (c) Windows and build-in ssh client for Linux/Unix/MACOS X systems.

NOTE: On Linux/UNIX/MACOS X systems run ssh command with -l parameter to specify the device login name if it is differs from the name of a user who initialise the SSH session.

3.2.4.6.5 RADIUS

The RADIUS (Remote Authentication in Dial-In User Service) is used to authenticate and authorise remote devices from the single place. Unlike the local authentication and authorisation, where USERNAME/PASSWORD/ACCESS_RIGHTS have to be created for every single unit in the network, the RADIUS authentication and authorisation means that user credentials must be created and stored only once on the RADIUS server. The remote RADIUS clients will connect to the RADIUS server and request user authentication and authorisation.

NOTE: RADIUS subsystem depends on Advanced Security settings. SECURE ON command has to be enabled before activating the RADIUS service

The MiniFlex modem acts as RADIUS client. It will request user authentication and authorisation from RADIUS server if operator will access command line or WEB interface of the device.

NOTE: The current realisation of RADIUS protocol is designed for authentication and authorisation of the device operator. It is not intended for granting or disallowing an access from LAN ports to the network.

MiniFlex RADIUS client supports one or two RADIUS servers. The following options are configurable:

Parameter	Value	Description
Server IP	IP Address	IP address of primary and secondary RADIUS Server.
Server port	0-65535	UDP Port, the RADIUS server is listen on for incoming connections. Default port is 1812.
Shared key	String (64 symbols)	A passphrase. It must be the same for RADIUS server and all clients. If two RADIUS servers are used, the passphrase can be unique for each server.
Retries	0-10	Number of retries, the client will use to authenticate the user on both RADIUS servers. 0 means no attempts. Default value is 2.
Timeout, seconds	1-5	Time interval between authentication attempts. Default value is 2 seconds.

The authentication and authorisation process has the following scenario: as soon as operator opens console session through Telnet, SSH or Serial interface, or if he opens WEB session and connects to the HTTP server of the device, the LOGIN prompt appears. Operator enters the USERNAME/PASSWORD pair and the RADIUS client (modem) sends authentication request to the first RADIUS server. If the USERNAME/PASSWORD pair match the server database, the operator will be authorized and access to CLI or WEB interface will be granted. If either USERNAME/PASSWORD pair, or shared key doesn't match the server database record, the access will be disallowed. Operator has 3 attempts per session to authenticate himself.
If first RADIUS server didn't reply during a defined timeout, the build-in modem RADIUS client tries to authenticate the user at the second RADIUS server. If the second server didn't reply, the client tries the first server again. This sequence keeps running until the number of retries counter expires. The number of retries is user defined.
If the whole authentication sequence fails, the build-in modem RADIUS client tries to authenticate and authorise the operator using the local user record.

NOTE: It is not possible to authenticate user with local user record, if at least one RADIUS server is running and accessible from the build-in client.

3.2.4.6.5.1 RADIUS Server Setup with Defined Vendor Specific Attributes

As an example we will configure freeradius server running on Linux Debian/Ubuntu platform. Server will use Vendor Specific Attributes field during message exchange.
Freeradius server can store its configuration in SQL database or in plain text files. We will select second way because of simplicity.

Vendor configuration. File dictionary.flexdsl
First of all we need to tell freeradius server to use Vendor Specific Attribute for the access to FlexDSL equipment. We need to create the following text file:

File is located at /usr/share/freeradius/dictionary.flexdsl

```
#
#
# Radius settings for FlexDSL units
#
#
VENDOR          FlexDSL         4249

BEGIN-VENDOR    FlexDSL
ATTRIBUTE       FlexDSL-Rights  0       string
END-VENDOR      FlexDSL
```

As a second step we need to connect newly created Vendor Specific file to the freeradius dictionary file:

File is located at /usr/share/freeradius/dictionary

String to add:

```
$INCLUDE dictionary.flexdsl
```

If Vendor Specific Attributes are used, the server will send the message containing two fields: <Vendor-Specific> <4249 0 ACCESS_RIGHTS_STRING>. Here 4249 is Vendor ID of FlexDSL Telecommunications AG. ACCESS_RIGHTS_STRING contains the user privileges.

Client configuration. File clients.conf.
We need to define RADIUS clients

Client configuration file contains the IP addresses of the modems with build-in RADIUS clients and shared secret passphrase. File is located at /etc/freeradius/clients.conf

```
# FlexDSL MiniFlex Clients
# Modems from network 192.168.1.0/24 will be authenticated using secret
```

```
# phrase. Don't forget to add "sharing secret" to Orion3 modem using
# RADIUS SECRET command
client 192.168.1.0/24 {
   secret = My1stSecretCode4Radius
   require_message_authenticator = no
   nastype = other
}
```

User configuration. File users
We need to create USERS with appropriate rights

User records are located at /etc/freeradius/users

```
# MiniFlex User with Administration rights
MINIFLEXADMIN Cleartext-Password := "AdminPass"
  FlexDSL-Rights = ALL,
  Framed-IP-Address = 192.168.169.0,
  Framed-IP-Netmask = 255.255.255.0

# MiniFlex User with User rights. Basic change of configuration
MINIFLEXUSER Cleartext-Password := "UserPass"
  FlexDSL-Rights = CONTROL,
  FlexDSL-Rights += TEST,
  FlexDSL-Rights += STATUS,
  FlexDSL-Rights += CONFIG,
  Framed-IP-Address = 192.168.169.0,
  Framed-IP-Netmask = 255.255.255.0

# MiniFlex User with Read-only rights
MINIFLEXOPERATOR Cleartext-Password := "OperatorPass"
  FlexDSL-Rights = TEST,
  FlexDSL-Rights += STATUS,
  Framed-IP-Address = 192.168.169.0,
  Framed-IP-Netmask = 255.255.255.0
```

NOTE: Don`t forget to restart freeradius server after changing configuration using `sudo service freeradius restart` command.

3.2.4.6.5.2 Simplified RADIUS Server Setup

Alternatively we can setup the freeradius server without Vendor Specific dictionary file and declare Vendor-Specific field in user configuration file instead

User configuration. File users
We need to create USERS with appropriate rights

User records are located at /etc/freeradius/users

```
# MiniFlex User with Administration rights
MINIFLEXADMIN Cleartext-Password := "AdminPass"
  Vendor-Specific = ALL,
  Framed-IP-Address = 192.168.1.0,
  Framed-IP-Netmask = 255.255.255.0

# MiniFlex User with User rights. Basic change of configuration
MINIFLEXUSER Cleartext-Password := "UserPass"
  Vendor-Specific = CONTROL,
  Vendor-Specific += TEST,
  Vendor-Specific += STATUS,
  Vendor-Specific += CONFIG,
  Framed-IP-Address = 192.168.1.0,
  Framed-IP-Netmask = 255.255.255.0

# MiniFlex User with Read-only rights
MINIFLEXOPERATOR Cleartext-Password := "OperatorPass"
  Vendor-Specific = TEST,
```

```
  Vendor-Specific += STATUS,
  Framed-IP-Address = 192.168.1.0,
  Framed-IP-Netmask = 255.255.255.0
```

Without Vendor Specific Attributes defined, the server will send the message containing two fields:

<Vendor-Specific> <ACCESS_RIGHTS_STRING>. No vendor ID will be attached to the message.

Client configuration file contains the same information as in the previous example.

Client configuration. File clients.conf.
We need to define RADIUS clients

Client configuration file contains the IP addresses of the modems with build-in RADIUS clients and shared secret passphrase. File is located at /etc/freeradius/clients.conf

```
# FlexDSL MiniFlex Clients
# Modems from network 192.168.1.0/24 will be authenticated using secret
# phrase. Don't forget to add "sharing secret" to MiniFlex modem using
# RADIUS SECRET command
client 192.168.1.0/24 {
   secret = My1stSecretCode4Radius
   require_message_authenticator = no
   nastype = other
}
```

NOTE: Don`t forget to restart freeradius server after changing configuration using `sudo service freeradius restart` command.

3.2.4.6.5.3 Configuring User Access Rights

The <Vendor-Specific> or <FlexDSL-Rights> field in RADIUS configuration tells the client what access rights the user has. It is possible to grant or discard access to various commands and menu items of the modem device. All commands of the CLI are divided into 3 levels. Selection of upper level means that the commands from low levels will be selected too. Some commands are available for every user, they can't be revoked.

Privileges

Hierarchy Levels			Description	Related commands	
Top Level	Group	Subgroup			
ALL			Commands of this level are available for everyone. No additional authorization is required	ALARM ALARM T DISCONNECT LINKCLEAR	TLM SENSOR ACO SOFTINFO
	CONTROL [CTRL]		Operation of remote devices	CONNECT	LINK
	TEST [T]		Test of the device	LOOP1 LOOP2 STARTAL RESTART	PING MACTABLE MACTABLE C BERT Submenu
	ADMIN [A]		Administration of the device	DIFF DUMP SERNUM LICENSE ACO change	SOFTUPDATE SOFTCONFIRM ID RESPONSE PASSWORD

				RESET BACKUP RESTORE LOAD TLM D TLM S TLM C SENSOR [N] [O/C] TFTP	NMTHR LATHR LICENSE ADD DEFAULT EVERYTHING SECURE LOG USERS USER APPLY CONFIRM
	STATUS [S]	:LINK	Link status	G826 G826 C G826 E1 G826 E1 C ALLG826 LINKSTAT LINKALARM ALARMLOG	NM LINKNM STATUS STATUS T STATUS L STATUS EXT POWER DIAG
		:LINKC	All commands from LINK + reset of the counters	RESETG826 RESETALLG826	ALARMLOG C
		:LAN	Ethernet status	NETSTAT NETERR	STATUS ETH MACTABLE
		:LANC	All commands from LAN + reset of Ethernet counters and MAC table	RESETNETSTAT MACTABLE C	

ALL	CONFIG [C]	:VIEW	Displaying of device configuration	CONFIG NETCONFIG	COSCONFIG RSTP CONF
		:LINK	All commands from VIEW +line, E1 and Nx64 interface configuration	DEFAULT AUTO MASTER EXT BASERATE PAM PAYLOAD ANNEX SETCLOCK MULTIPAIR RESERVE G704 CRC4 AISDET AISGEN DSLTS WANTS	E1CLOCK E1MODE POWER GSCOMPAT PTMP MODE N RSRATE RSFORMAT RSDUPLEX AUTOLOOP EXTCLOCK N64RATE WAN WANIDLE APPLY CONFIRM
		:LAN	All commands from VIEW + LAN configuration	NETDEFAULT RSTP DEFAULT RSTP STATE RSTP ... PBVLAN MODE [IF] VLAN QOS ALLOW VID	ETHSD FC IRATE ERATE CRATE COS PING APPLY CONFIRM
		:SNMP	All commands	TRAPIP	RMONALARM

		from VIEW + SNMP configuration	COMMUNITY SNMPSET SNMPACL	RMONEVENT APPLY CONFIRM
	:NET	All commands from VIEW + IP configuration	SETIP GATEWAY NETMASK MTU SYSLOG	SNTP APPLY CONFIRM PING

NOTE: The abridgements in braces "[ ]" can be entered instead of complete name.
If group has been entered without subgroup definitions, all subgroups will become available.
To define subgroup, type it after group name with ":" in the beginning of a subgroup.
The WEB interface will follow the rights of CLI interface.

In the RADIUS Server configuration example three different users have been defined in the users file.

User MINIFLEXADMIN has full access to the device, because <Vendor-Specific> or <FlexDSL-Rights> field is set to ALL.
MINIFLEXUSER has partial access, because <Vendor-Specific> or <FlexDSL-Rights> filed is set to CONTROL + TEST + STATUS + CONFIG.
MINIFLEXOPERATOR can only perform tests and check device status, because <Vendor-Specific> or <FlexDSL-Rights> field is set to TEST + STATUS.

3.2.5 SHDSL DINrail Modem

The SHDSL Line Card is available in a DINrail housing too. All the interfaces and the software functionality is exactly the same. The local power supply can be DC or AC Voltage:

- -24V models have18-72VDC local power supply
- -230V models have 85-264VAC and 120-370VDC local power supply

The dimension is 143(W)x87(D)x37(H) mm or 153(W)x87(D)x37(H) mm with the clip.

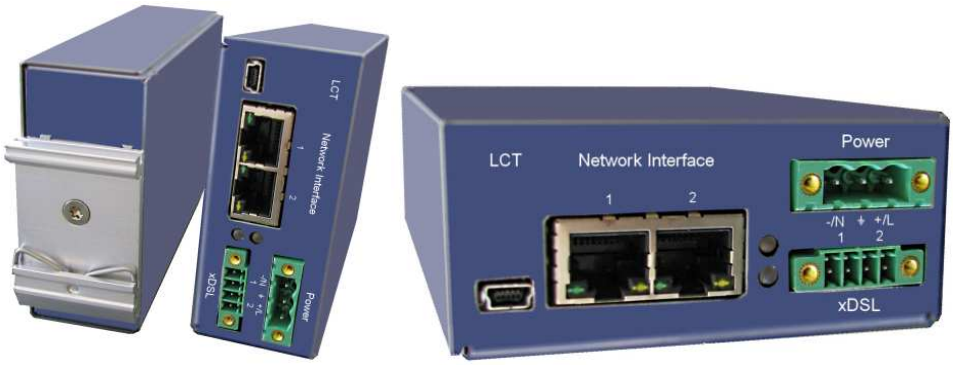


Figure 3.17 SHDSL DINrail Modem

3.2.6 Single or Dual FOM Line Card

The FOM Line Card has one or two SFP slot interface for any SFP module (100Base-FX, OC-3/STM-1). There is also a local craft terminal on every line card to manage and configure if there is any ethernet failure of the main switch in the MiniFlex.

Figure 3.18 Single and Dual FOM Line Cards

Element		Description	
LCT		USB Connector Local Craft Terminal	
LED-1	LED-2	LED Red/Green/Amber Ethernet Backside	LED Red/Green/Amber SFP slot Frontside
SFP		SFP slot for any module with speed up to 155Mbps.	

Table 3.13 Connectors and LEDs on the front panel of the single FOM Line Card.

Element		Description	
LCT		USB Connector Local Craft Terminal	
		RJ-45 10/100Mbps Ethernet Port 1 + two LED	
		RJ-45 10/100Mbps Ethernet Port 2 + two LED	
LED-1-1	LED-1-2		LED Red/Green/Amber SFP slot Frontside
SFP		SFP slot for any module with speed up to 155Mbps.	
LED-1-1	LED-1-2		LED Red/Green/Amber SFP slot Frontside
SFP		SFP slot for any module with speed up to 155Mbps.	

Table 3.14 Connectors and LEDs on the front panel of the dual FOM Line Card.

3.2.6.1 Line Card SFP and Ethernet Interface

Please see the interface description of the SHDSL line card.

3.2.6.2 Line Card Alarm and LED Description

The LEDs display the normal operation conditions and the alarm conditions of each line card and of each interface according to the following tables. To display an urgent alarm has always the highest priority and will overwrite a non-urgent alarm.

Element	Description
LED 1	Status Ethernet Interface Backplane
LED 2	Status SFP Module

Led Color	
Status Ethernet Backplane Interface	
Connection is active	Green
Connection is not active	Off
Data receive and/or transmit	Amber Blinking
System Error	Red
Power fail	Off
Status SFP Interface	
Connection is active	Green
Data receive and/or transmit	Amber Blinking
No SFP module inserted	Off
Power fail	Off

Table 3.15 Single FOM Line Card LED behaviour according to the interface status.

Element	Description
Two LED on RJ-45	Status 1st Ethernet Led1=Green, Led2=Amber
Two LED on RJ-45	Status 2nd Ethernet Interface Led1=Green, Led2=Amber
Two LED SFP	Status 1st SFP Ethernet Interface Led1=Green, Led2=Amber
Two LED SFP	Status 2nd SFP Ethernet Interface Led1=Green, Led2=Amber

Led Color		
Status Ethernet and SFP Interface		
Connection is active	Led1	Green
Connection is not active		Off
Data receive and/or transmit		Green Blinking
100 Mbit/s receive/transmit rate	Led2	Amber
10 Mbit/s receive/transmit rate		Off

Table 3.16 Dual FOM Line Card LED behaviour according to the interface status.

3.2.7 Single or Dual FOM DINrail Modem

The single and dual FOM Line Card is available in a DINrail housing too. All the interfaces and the software functionality is exactly the same. The local power supply can be DC or AC Voltage:

- -24V models have18-72VDC local power supply
- -230V models have 85-264VAC and 120-370VDC local power supply

The dimension for the single one is 143(W)x87(D)x37(H) mm or 153(W)x87(D)x37(H) mm with the clip. The dimension for the dual one is 143(W)x87(D)x43(H) mm or 153(W)x87(D)x43(H) mm with the clip.

Figure 3.19 Single and Dual FOM DINrail Modem

3.2.8 POE Line Card

ATTENTION

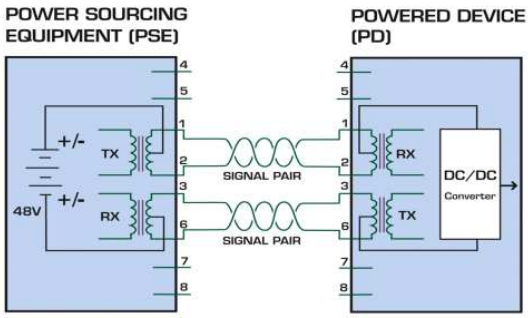
The POE (power over Ethernet) line card has two Ethernet ports suporting the IEEE 802.3af standard with 15.4 Watts. Attention, this line card can only be used with the Minirack (MF-MR-RAIL-2U4S,V1) and not with the normal subrack (MF-MR2N-SW-12Eth,V1).

Figure 3.20 POE Line Card

Element		Description	
		RJ-45 10/100Mbps Ethernet Port 1 + two LED	
		RJ-45 10/100Mbps Ethernet Port 2 + two LED	
LED-1	LED-2	LED Green POE status 1	LED Green POE status 2

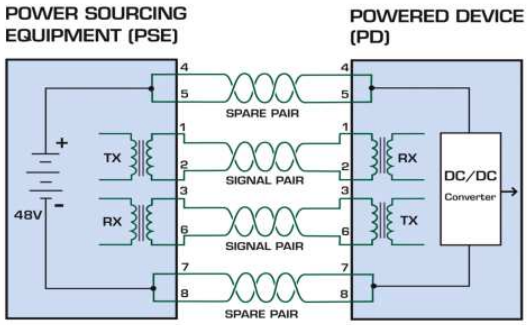
Table 3.17 Connectors and LEDs on the front panel of POE Line Card

The POE Line Card can be configured by jumpers for the wished powering scheme.



Mode A

802.3af PoE Mode A combine's power onto the same wires as the data signal using a technique called Phantom Powering



Mode B

802.3af PoE Mode B uses the Ethernet spare pairs 4/5 and 7/8 to carry power. Pairs 1/2 and 3/6 are left untouched and carry data for 10/100BaseT.

Figure 3.21 Jumpers on POE Line Card

Internal/External Power			
X301 & X302	**Mode**	**Condition**	**Power at PD**
Pin1-3 **Pin2-4**	Default Mode 15.4 Watts per Interface. IEEE802.3af	External Power must be 18-72VDC. POE uses on board DC/DC converter.	12.95Watts
Pin3-5 **Pin4-6**	External Power Mode. 40.0 Watts per Interface IEEE802.3at	External Power must be 44-54VDC. POE uses external power.	34.20Watts

Mode A and Mode B Configuration			
X404 & X405	**Mode**	**Condition**	**Power at PD**
Pin1-2 **Pin5-6**	Mode A	X404 for PoE-2 X405 for PoE-1	Depending X301 & X302 & X406
Pin3-4 **Pin7-8**	Mode B	X404 for PoE-2 X405 for PoE-1	Depending X301 & X302 & X406
Pin1-2 **Pin3-4** **Pin5-6** **Pin7-8**	Mode A & Mode B	X404 for PoE-2 X405 for PoE-1	Depending X301 & X302 & X406

Power Polarity MDI or MDI-X			
X402 & X403	**Polarity**	**Mode A**	**Mode B**
Pin1-3 **Pin2-4**	MDI-X	Pin1/2 -48VDC Pin3/6 0VDC	Pin4/5 -48VDC Pin7/8 0VDC
Pin3-5 **Pin4-6**	MDI	Pin1/2 0VDC Pin3/6 -48VDC	Pin4/5 0VDC Pin7/8 -48VDC

Special Combined Mode A and Mode B			
X406		**Condition**	**Power at PD**
Pin1-3 **Pin2-4**	PoE-1 Mode A PoE-1 Mode B PoE-2 not used	PoE-1 uses two on board DC/DC converter. One for Mode A other for Mode B.	2x 12.95Watts
Pin3-5 **Pin4-6**	PoE-1 normal use PoE-2 normal use	Default	Depending X301 & X302

3.2.8.1 Line Card LED Description

The LEDs display the normal operation conditions of each line card and of each interface according to the following table.

Element	Description
Two LED on RJ-45	Status 1st Ethernet Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 2nd Ethernet Interface Led1=Green, Led2=Amber
LED 1	Status 1st Power over Ethernet
LED 2	Status 2nd Power over Ethernet

Led Color		
Status Ethernet Interface		
Connection is active	Led1	Green
Connection is not active		Off
Data receive and/or transmit		Green Blinking
100 Mbit/s receive/transmit rate	Led2	Amber
10 Mbit/s receive/transmit rate		Off
Status POE on Ethernet Interface		
Power is off		Off
Normal operation, Power is on		Green

Table 3.18 POE Line Card LED behaviour according to the interface status.

3.2.9 POE DINrail Unit

The POE Line Card is available in a DINrail housing too. It has one Ethernet input (LAN) and one Ethernet with Power output (PoE). All interfaces functionality is exactly the same as for the line card. The local power supply is DC Voltage:

- -24V model has18-72VDC local power supply

The dimension is 143(W)x87(D)x37(H) mm or 153(W)x87(D)x37(H) mm with the clip.

Figure 3.22 POE DINrail Unit

3.2.10 Managed Switch Line Card

The managed Switch Line Card has four 10/100Base-T Ethernet ports as front access and up to additional four 10/100Base-T Ethernet ports as back access (backplane). Attention, the four ports at the backplane can only be used with the Minirack (MF-MR-RAIL-2U4S,V1) and not with the normal subrack (MF-MR2N-SW-12Eth,V1). When using a normal subrack, there is only one Ethernet port available at the backplane.

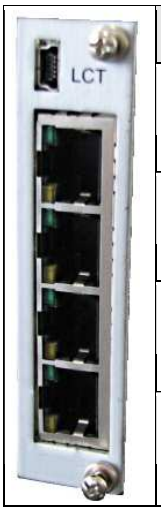
Figure 3.23 Managed Switch Line Card

Element	Description
LCT	USB Connector Local Craft Terminal
	RJ-45 10/100Mbps Ethernet Port 1 + two LED
	RJ-45 10/100Mbps Ethernet Port 2 + two LED
	RJ-45 10/100Mbps Ethernet Port 3 + two LED
	RJ-45 10/100Mbps Ethernet Port 4 + two LED

Table 3.19 Connectors and LEDs on the front panel of the managed Switch Line Card.

3.2.10.1 Line Card LED Description

The LEDs display the normal operation conditions of each line card and of each interface according to the following table.



Element	Description
Two LED on RJ-45	Status 1st Ethernet Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 2nd Ethernet Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 3rd Ethernet Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 4th Ethernet Interface Led1=Green, Led2=Amber

Led Color		
Status Ethernet Interface		
Connection is active	Led1	Green
Connection is not active		Off
Data receive and/or transmit		Green Blinking
100 Mbit/s receive/transmit rate	Led2	Amber
10 Mbit/s receive/transmit rate		Off

Table 3.20 Managed Switch Line Card LED behaviour according to the interface status.

3.2.11 Managed Switch DINrail Unit

The Managed Switch Line Card is available in a DINrail housing too. All the interfaces and the software functionality is exactly the same. The local power supply can be DC or AC Voltage:

- -24V models have18-72VDC local power supply
- -230V models have 85-264VAC and 120-370VDC local power supply

The dimension is 143(W)x87(D)x43(H) mm or 153(W)x87(D)x43(H) mm with the clip.

Figure 3.24 Managed Switch DINrail Unit

3.2.12 Serial RS-232/422/485 Interface Line Card

The Serial RS-232/422/485 Line Card has one serial interface, two SFP slot interface for any SFP module (100Base-FX, OC-3/STM-1) and an additional 10/100Base-T Ethernet port as front access and one Ethernet ports as back access (backplane). There is also a local craft terminal on every line card to manage and configure if there is any ethernet failure of the main switch in the MiniFlex.

Figure 3.25 Serial RS-232/422/485 Interface Line Card

Element		Description	
LCT		USB Connector Local Craft Terminal	
		RJ-45 Serial Port + two LED	
		RJ-45 10/100Mbps Ethernet Port + two LED	
LED-1-1	LED-1-2		LED Red/Green/Amber SFP slot Frontside
SFP		SFP slot for any module with speed up to 155Mbps.	
LED-1-1	LED-1-2		LED Red/Green/Amber SFP slot Frontside
SFP		SFP slot for any module with speed up to 155Mbps.	

Table 3.21 Connectors and LEDs on the front panel of the Serial RS-232/422/485 Interface Line Card.

3.2.12.1 Line Card SFP and Ethernet Interface

Please see the interface description of the SHDSL line card.

3.2.12.2 Line Card Serial RS-232/422/485 Interface

The serial interface can be configured to be RS-232 or RS-422/485 with following features:

- Speed 75, 150, 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 56000, 57600, 115200, 230400 bps
- number of data bits: 5…8
- number of stop bits:1, 1.5 or 2
- parity: odd/even/mark/space

You can use the command RSRATE [N] to set the baud rate (N is baudrate, for instance 9600). The command RSFORMAT [format] is used to set the data format (example of format: 8N1).

3.2.12.3 Line Card Alarm and LED Description

The LEDs display the normal operation conditions and the alarm conditions of each line card and of each interface according to the following tables. To display an urgent alarm has always the highest priority and will overwrite a non-urgent alarm.

Element	Description
Two LED on RJ-45	Status Serial Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status Ethernet Interface Led1=Green, Led2=Amber
Two LED SFP	Status 1st SFP Ethernet Interface Led1=Green, Led2=Amber
Two LED SFP	Status 2nd SFP Ethernet Interface Led1=Green, Led2=Amber

Led Color		
Status Ethernet and SFP Interface		
Connection is active	Led1	Green
Connection is not active		Off
Data receive and/or transmit		Green Blinking
100 Mbit/s receive/transmit rate	Led2	Amber
10 Mbit/s receive/transmit rate		Off

Status RS-232/422/485 Interface		
RS-232 data receive/transmit	Led1	Green RX/TX
RS-422/485 data receive/transmit		Green RX/TX
RS-232 control RTS/CTS	Led2	Amber R/CTS
RS-422/485		Off

Table 3.22 Serial RS-232/422/485 Interface Line Card LED behaviour according to the interface status.

3.2.13 Serial RS-232/422/485 Interface DINrail Modem

The Serial RS-232/422/485 Interface Line Card is available in a DINrail housing too. All the interfaces and the software functionality is exactly the same. The local power supply can be DC or AC Voltage:

- -24V models have18-72VDC local power supply
- -230V models have 85-264VAC and 120-370VDC local power supply

The dimension is 143(W)x87(D)x43(H) mm or 153(W)x87(D)x43(H) mm with the clip.

Figure 3.26 Serial RS-232/422/485 Interface DINrail Modem

3.2.14 Serial RS-232 Line Card

The Serial RS-232 Line Card has four RS-232 (V.24/28) ports as front access and one 10/100Base-T Ethernet ports as back access (backplane).

Figure 3.27 Serial RS-232 Line Card

Element	Description
LCT	USB Connector Local Craft Terminal
	RJ-45 RS-232 Port 1 + two LED
	RJ-45 RS-232 Port 2 + two LED
	RJ-45 RS-232 Port 3 + two LED
	RJ-45 RS-232 Port 4 + two LED

Table 3.23 Connectors and LEDs on the front panel of the Serial RS-232 Line Card.

3.2.14.1 Line Card Serial Interface

The serial RS-232 interfaces have following features:

- Speed 75, 1200, 2400, 9600, 19200, 38400, 57600, 115200, 230400 bps
- number of data bits: 5…8
- number of stop bits:1, 1.5 or 2
- parity: odd/even/mark/space

You can use the command RSRATE [N] to set the baud rate (N is baudrate, for instance 9600). The command RSFORMAT [format] is used to set the data format (example of format: 8N1).

3.2.14.2 Line Card LED Description

The LEDs display the normal operation conditions of each line card and of each interface according to the following table.

Element	Description
Two LED on RJ-45	Status 1st RS-232 Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 2nd RS-232 Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 3rd RS-232 Interface Led1=Green, Led2=Amber
Two LED on RJ-45	Status 4th RS-232 Interface Led1=Green, Led2=Amber

Led Color		
Status RS-232/422/485 Interface		
RS-232 data receive/transmit	Led1	Green RX/TX
RS-422/485 data receive/transmit		Green RX/TX
RS-232 control RTS/CTS	Led2	Amber R/CTS
RS-422/485		Off

Table 3.24 Serial RS-232 line card LED behaviour according to the interface status.

3.2.15 Serial RS-232 DINrail Unit

The managed serial RS-232 line card is available in a DINrail housing too. But it has only two RS-232 interfaces and additionally it has two SFP slot interfaces for any SFP module (100Base-FX, OC-3/STM-1). The local power supply can be DC or AC Voltage:

- -24V models have18-72VDC local power supply
- -230V models have 85-264VAC and 120-370VDC local power supply

The dimension is 143(W)x87(D)x43(H) mm or 153(W)x87(D)x43(H) mm with the clip.

Figure 3.28 Serial RS-232 DINrail Unit

3.2.16 Default IP Address

3.2.16.1 DINrail Unit

Figure 3.29: The default IP address for a dinrail unit is 192.168.0.235.

3.2.16.2 MiniRack

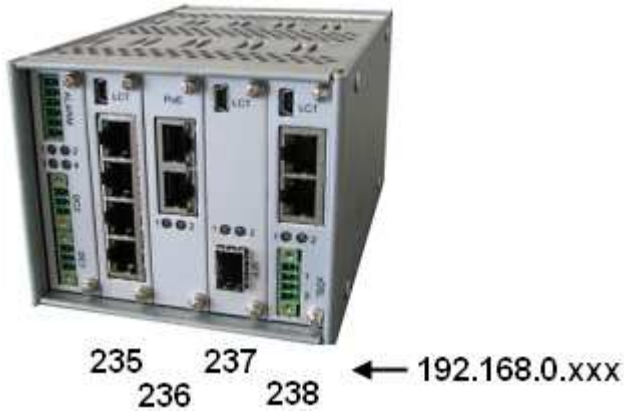


Figure 3.30: The default IP address for a minirack unit starts from left with 192.168.0.235 and ends on the right side with 192.168.0.238.

3.2.16.3 Subrack with Integrated Switch

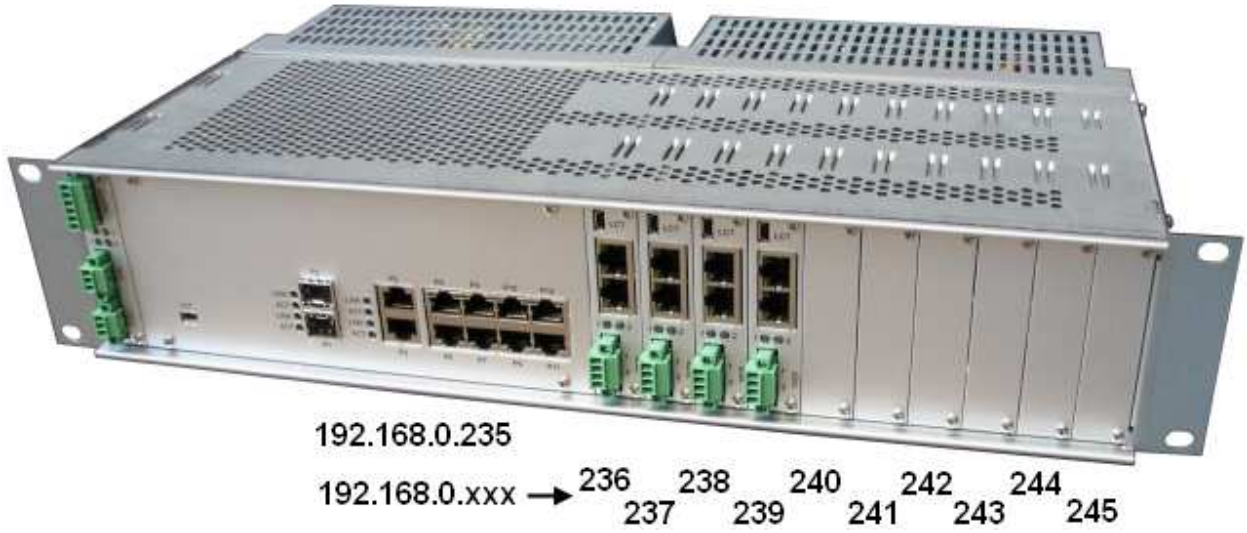


Figure 3.31: The default IP address for a subrack unit starts from left side with 192.168.0.235 for the included Switch. The line cards start from left side with 192.168.0.236 and end on the right side with 192.168.0.245.

3.2.16.4 Line Card

Figure 3.32: The default IP address for a single delivered line card is 192.168.0.236.

4 PROGRAMMING GUIDE MINIFLEX SWITCH

4.1 MiniFlex Command Line Interface

MiniFlex command line interface (CLI) has a clear syntax and could be accessed from: Local Craft Terminal connected to USB interface; from Remote Host connected to MiniFlex over Telnet or SSH session. To configure all system parameters, user has to type command in a terminal window. Each ***command*** must be confirmed with **Enter** key. List of other useful key combinations represented in Table 4-1.

Key sequence	Description
BackSpace or Ctrl+h	Erase the character to the left of the cursor
The up arrow key or Ctrl+P	Recall the commands in the history buffer, beginning with the most recent command.
The left arrow key or Ctrl+B	Move the cursor back one character
The right arrow key or Ctrl+F	Move the cursor forward one character
The down arrow key or Ctrl+N	Selection of recent commands in the history buffer. Selection is valid after recalling the resent command by up arrow key or Ctrl+P
Ctrl+A	Move the cursor to the beginning of the command line
Ctrl+E	Move the cursor to the end of the command line
Ctrl+D	Delete the character at the cursor
Ctrl+K	Delete all characters from the cursor to the end of the command line
Ctrl+T	Transpose the current character and character located left from the cursor
Ctrl+U	Delete all characters from the cursor to the beginning of the command line
Ctrl+W	Delete the word to the left of the cursor

Table 4-1. MiniFlex CLI key combinations.

Any command could have several parameters. Parameters could be obligatory and optionally. Please refer to Table 4-2 for explanation of meanings of different fonts and symbols inside the user manual.

String	Description
command	A word with ***Courier Italic*** font is a command that user has to type. It must be confirmed with **Enter** key.
<parameter>	A word inside **"less then"** and **"greater then"** signs is an obligatory parameter that must be entered. It could be a string or an digital array
[parameter]	A word inside **square braces** is an obligatory parameter that must be chosen.
param1 ¦ param2	Parameter 1 **or** Parameter 2 should be used
{Parameter}*1	A parameter in Braces is optional. The command behind asterisk indicates the number of the commands in command line.
Text output	A text with `courier` font is a live screen capture of MiniFlex CLI

Table 4-2. Various fonts and symbols in the user manual.

Any command of CLI could be completed with **TAB** key. For example, a user type ***sh*** and press **TAB** key; CLI will complete a command and ***show*** will be displayed. If a user press **TAB** after

completing a command, a list of all possible variants or a message that command is complete, will be shown:

```
FXOS> show
dhcp              dhcpr             dot1x             fdb
gvrp              history           idle-timeout      interface
port              radius            services          startup-config
syscontact        syslocation       terminal          version
FXOS> show
```

If a user type a question mark ***?*** symbol while typing a command, a list of available commands with their short meanings will be displayed:

```
FXOS>
  clear     Clear screen
  enable    Turn on privileged mode command
  exit      Exit current mode and back to previous mode
  help      Description of the interactive help system
  list      Print command list
  logout    Disconnect from switch and quit
  no        Negate a command or set its defaults
  ping      Ping command to test if the net is correct
  quit      Disconnect from switch and quit
  show      Show running system information
  terminal  Set terminal line parameters
  who       Display who is connected to the switch
FXOS>
```

If a user type ***?*** after typing a command or after typing a part of a command, for example ***sh?***, a help for a command will be displayed:

```
FXOS> sh
  show  Show running system information
FXOS> show
  dhcp            Show dhcp information
  dhcpr           Show information of dhcp relay
  dot1x           Show dot1x information
  fdb             Config FDB entries information
  gvrp            Show GARP Vlan Registration Protocol information
  history         Display the session command history
  idle-timeout    Idle timeout value in minutes and seconds
  interface       Show interfaces in the system
  port            Show port information
  radius          Show RADIUS client information
  services        Show information of system services status
  startup-config  Show contents of startup configuration
  syscontact      Show the person who manage this host and how to contact this
                  person
  syslocation     Show the physical location of this host
  terminal        Show terminal line parameters
  version         Show version information
FXOS> show
```

It is possible to type only a part of a command, for example ***sh ve*** is equal to ***show version*** command.

A MiniFlex CLI will be accessible after successful boot of a device. A normal booting sequence is represented below:

```
Bootloader version 1.1
Check the system memory...OK

Checking the system flash file system...OK

OS is starting ...

Initializing Network Service ......

Initializing Management Service ......
```

```
Boot with empty configuration ...

################################################################
#                                                              #
#                       Welcome to FXOS                        #
#                                                              #
#      Press Return to connect and config this system.         #
#                                                              #
################################################################
```

Press Enter key to login into a system.

Default user name and password are admin

After successful login, system information will be displayed:

```
MODEL FG-MINIFLEX-SW18/4,V1
HWRV 00AA
SW Version 1.3(Build 0002 on 10:07:47 Jan 27 2010)
DATE 27-1-2010
HOSTNAME FlexDSL
SYSTEM_DATE_AND_TIME 1970/1/1 00:04:00
RUNS 0d 0:4:50
MODEL_DESC Minirack L2 18FE/4GE Ethernet Managed Switch
IP 192.168.0.254
MGMT_VLAN default
(c) FlexDSL Telecommunications AG
FXOS>
```

User could clear screen with ***clear*** command.

4.2 Getting Help

An easiest way to get help from command line is to type ***help***

```
FXOS(config-vlan-research)#help

      FXOS provides help feature as described below.

      1. Anytime you need help, just press "?" and don't
    press Enter, you can see each possible command argument
    and its description.

      2. You can also input "list" and then press Enter
    to execute this helpful command to view the list of
    commands you can use.

FXOS(config-vlan-research)#
```

To get a list of available commands type ***list {command name}***. Command name could be not completed.

4.3 Read-Only and Privileged modes of operation

A MiniFlex CLI could work in read-only and in privileged modes. A command line prompt for read-only mode is **>**. In privileged mode a command line prompt is **#**.

4.3.1 Entering to and exiting from privileged mode

enable to enter in privileged mode

exit to exit to read-only mode

Default password for privileged mode is admin

Commands that could affect a system operation are accessible in privileged mode only. They will not be displayed under ***help*** or ***list*** commands if executed from read-only mode.

4.4 User Management

There is only one user presents in a system by default. It has administrator rights and could access to privileged mode. Default user name is **admin**.

User could create other users and grant them rights of a normal user or of an administrator.

4.4.1 Creating a user

user add <username> login-password <login-password>

4.4.2 Configuring user rights

user role <username> [admin ¦ normal]

4.4.3 Changing a password for privileged mode

user enable-password <enable-password> <username>

4.4.4 Changing a login password for a user

user login-password <username>

4.4.5 Getting a list of users

user list

4.4.6 Deleting a user

user delete <username>

4.5 Setting up a System Date and Time

A MiniFlex switch could synchronize its internal clock with a real-time clock server located in the Internet using Simple Network Time Protocol (SNTP), or a user could configure a system clock and date manually.

4.5.1 An automatic System Date and Time Settings

This case could be used if MiniFlex switch is connected to the Internet or to Intranet Network Time Protocol (NTP) server. An internal SNTP Client (SNTPC) should be configured according to the steps from Table 4-3.

#	Command	Description
1	`config sntpc serverip <A.B.C.D>`	Setup an IP address of Network Time Protocol Server. 204.152.184.72 could be

		used as an example.
2	`config sntpc timezone <west ¦ east> <0 -12>`	Configure a node time zone. East or West means where node is located from Greenwich meridian. 0 - 12 are time zone number, counted from it.
3	`config sntpc interval hours <0 - 1000> minutes <0 - 59>`	Select a time update interval in hours and minutes
4	`config sntpc enable`	Type this command to enable a SNTP client.

Table 4-3. Setting up a SNTP Client

To check the status of the SNTP Client type:

show sntpc status

A following output will be shown:

```
FXOS(config)# show sntpc status
SNTP client status        :    enable
SNTP client clock status  :    synchronized
SNTP reference server ip  :    204.152.184.72
SNTP client poll interval :    0 hour(s) 1 minute(s)
SNTP client timezone      :    east 1
FXOS(config)#
```

Please make sure that your node has an access to Internet or Intranet NTP server.

4.5.2 Manual System Date and Time Settings

This case could be used if MiniFlex switch has no access to Internet and corporate network has no NTP server. User has to configure system date and time manually according to steps from Table 4-4.

#	Command	Description
1	`config sntpc disable`	Make sure that SNTP Client is disabled.
2	`config system date year <1970 - 2036> month <1 - 12> day <1 – 31>`	Configure a node date
3	`config system hour <0 - 23> minute <0 – 59>`	Configure a node time

Table 4-4. Manual Date and Time configuration.

4.5.3 System Date and Time Displaying

show system time

```
FXOS(config)# show system time
Year:2010  Month:2  Day:1
Hour:13  Minute:51  Second:8
FXOS(config)#
```

4.6 Understanding your environment

Before going deep it is important to understand an existing configuration of your node. This chapter describes how to check it.

4.6.1 Checking your access rights

who am i

```
FXOS(config)# who am i
I am *Session [11] : user admin connected from console.
FXOS(config)#
```

4.6.2 Checking who else is connected to a system

who

```
FXOS(config)# who
SessionID. - UserName ---------- LOCATION ---------- MODE ----
11           admin               console             CONFIG    (That's me.)
13           testuser            192.168.169.12      VIEW
Total 2 sessions in current system.
FXOS(config)#
```

4.6.3 Dropping a session of another user

Check a session you want to drop with ***who*** command and then:

kill session <1 – 19999>

4.6.4 Checking a node you connected to

show syslocation

User could configure system location with ***config syslocation <.location (100 Char)>*** command

4.6.5 Checking a contact person

show syscontact

User could add a contact person name and a phone with ***config syscontact <.contact (100 Char)>*** command

4.6.6 Check software version

show version

```
FXOS(config)# show version

MODEL FG-SW8/4-RAIL,V1
HWRV 00AA
SW Version 1.3(Build 0002 on 10:07:47 Jan 27 2010)
DATE 27-1-2010
MODEL_DESC DIN-Rail L2 8FE/4GE Ethernet Managed Switch
OS FXOS
SN HEM100300001  1001
MAC 00:0f:d9:da:c1:25

FXOS(config)#
```

4.6.7 Setting an IP address of a switch

To set up an IP address for a switch ***ip <A.B.C.D/M> gateway <A.B.C.D>*** command is used.

```
FXOS(config)# ip 192.168.100.137/24 gateway 192.168.100.254
```

4.6.8 Deleting a IP address of a switch

To delete an IP address a ***no ip*** command is used.

```
FXOS(config)# no ip
```

4.6.9 Check an IP address and switching configuration of a node

A node IP address is displayed after successful login:

```
Login: admin
Password:

MODEL FG-MINIFLEX-SW18/4,V1
HWRV 00AA
SW Version 1.3(Build 0002 on 10:07:47 Jan 27 2010)
DATE 27-1-2010
HOSTNAME FlexDSL
SYSTEM_DATE_AND_TIME 2010/2/1 17:04:00
RUNS 2d 23:35:17
MODEL_DESC DIN-Rail L2 8FE/4GE Ethernet Managed Switch
IP 192.168.169.239
MGMT_VLAN default
(c) FlexDSL Telecommunications AG

FXOS>
```

It is also possible to find an IP address and switching configuration with a command:

show interface vlan

```
FXOS> show interface vlan
Interface VLAN default:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :1
  Vlan Type                      :Port-based
  IP Address                     :192.168.169.239/24
  Gateway                        :192.168.169.254
  Learn status                   :enable

  Port member list:
    eth1/1(u)      eth1/2(u)      eth1/3(u)      eth1/4(u)
 < ----------------------Skipped------------------------>
FXOS>
```

4.6.10 List interface status

show interface ethernet

```
FXOS(config)# show interface ethernet
Interface Ethernet eth1/1:

  Link status                    :Down
  Administrative status          :Up
  Port type                      :1000Base-TX
  AutoNegotiation                :disabled
  AutoNegotiation capability     :1000M
  Current speed                  :1000M
```

```
  Duplex                          :full
  FlowControl                     :disabled
  Learning                        :enabled
  MAC limit                       :0
  Port-bridge                     :disabled
  Trust                           :enabled
  Ip-vlan                         :disabled
  Mac-vlan                        :disabled

  Be added into vlan(s):
    Vlan name:default, vlan ID:1 , untagged

Interface Ethernet eth1/2:
< ----------------------Skipped------------------------>
```

4.6.11 Display a forwarding database (FDB)

show fdb

```
FXOS(config)# show fdb
--------  Begin of FDB Table Information ----------

VLAN name                 Mac address    Type        Interface   Queue
------------------------- -------------- ----------- ----------- ------
default                   000f.d9da.c125 permanent   CPU         3
default                   0100.5e00.0001 mcast       CPU         0
default                   001c.c423.5dcc dynamic     1/4         0
default                   0030.4f4d.c3bb dynamic     1/4         0
------------------------- -------------- ----------- ----------- ------

Total 4 MAC address filter entry showed.

----------  End of FDB Table Information ----------
FXOS(config)#
```

4.6.12 Get a technical support.

A User may be asked to provide full technical setup for possible debugging and solution reproducing at manufacturer's laboratory. It could happen if a user asks for a technical support. Please provide a live capture of a following command and send it to your support engineer:

show tech-support

4.7 Saving and restoring a system configuration

A MiniFlex switch has four different configurations:

- Startup configuration – a configuration that will be loaded during system startup
- Running configuration – a current configuration
- Backup configuration – a reserve copy of some configuration
- Factory default – an original configuration with default parameters.

Upon first system start a factory default configuration is loaded to MiniFlex Switch. Startup configuration has left unchanged until a User makes changes and saves a new configuration. A new configuration will be loaded during next system boot.

A User could save a second copy of current configuration as a backup configuration and restore it later as a startup configuration.

4.7.1 Saving a current configuration as a startup configuration

It is important to know that any command User types and confirms with **Enter** key become valid immediately. A User creates desired configuration command by command, and, if created configuration complies to his needs he can store it in system EEPROM. A User could also reboot a switch without saving a configuration. A previously made startup configuration will be loaded after system boot. If no startup configuration was created, a factory default configuration will be loaded during next system boot.

To save current configuration into startup configuration type:

save configuration

```
FXOS(config)# save configuration
Trying to save configuration to flash, please wait...
Preparing data for saving configuration...Done.

Starting writing configuration data to flash...Done.

Configuration saved to flash successfully.

FXOS(config)#
```

4.7.2 Saving current configuration as a backup configuration

Backup configuration gave an additional flexibility to a User. He could store a second working configuration as a backup and quick use it if new configuration was wrong. To save current configuration as a backup configuration type:

save backup-config

```
FXOS(config)# save backup-config
Trying to save configuration to flash, please wait...
Preparing data for saving configuration...Done.

Starting writing configuration data to flash...
Done.

Configuration saved to flash successfully.

FXOS(config)#
```

4.7.3 Restoring a backup configuration

To restore backup configuration type:

restore backup-config

```
FXOS(config)# restore backup-config
Trying to save backup configuration as startup configuration, please wait...
Preparing data for saving configuration...Done.

Starting writing configuration data to flash...Done.

Configuration saved to flash successfully.

FXOS(config)#
```

A backup-configuration will not be destroyed after restoring.

Please note that restored configuration will be effective only after system reboot

4.7.4 Restoring a factory defaults

To restore factory defaults a User needs to erase a startup configuration with a command:

erase startup-config

```
FXOS(config)# erase startup-config
Are you sure to erase startup-config? [Y/N]Y

Trying to erase all configuration from flash, please wait ......
Finished.
Successfully erase all config information from flash.


FXOS(config)#
```

A backup-configuration will not be destroyed after restoring.

Please note to reboot a switch to activate factory default configuration.

4.7.5 Rebooting a switch

During system reboot a switch rereads a startup configuration, if startup configuration exists. To reboot a switch please type a command:

reboot

```
FXOS(config)# reboot
Are you sure to reboot switch system? [Y/N]Y

System is going to reboot......

Disconnected.
```

4.7.6 Viewing a configuration and storing it on a PC

It is possible to view startup, running and backup configuration and store it on a PC for future download or for archiving purposes. A method how to store a configuration depends on terminal software used for accessing to CLI.

4.7.6.1 Viewing a running configuration

show running-config

```
FXOS(config)# show running-config
!FXOS system config file
!Version 1.3(1.2.0)
!Basic information config
 config sysname test123test
< ----------------------Skipped------------------------>
```

4.7.6.2 Viewing a startup configuration

show startup-config

```
FXOS(config)# show startup-config
!FXOS system config file
!Version 1.3(1.2.0)
!Basic information config
 config sysname test123test
< ----------------------Skipped------------------------>
```

4.7.6.3 Viewing a backup configuration

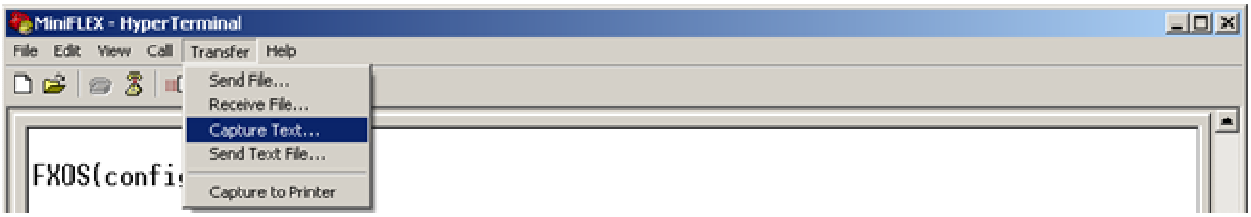
show backup-config

```
FXOS(config)# show backup-config
!FXOS system config file
!Version 1.3(1.2.0)
!Basic information config
 config sysname test123test
< ---------------------Skipped----------------------->
```

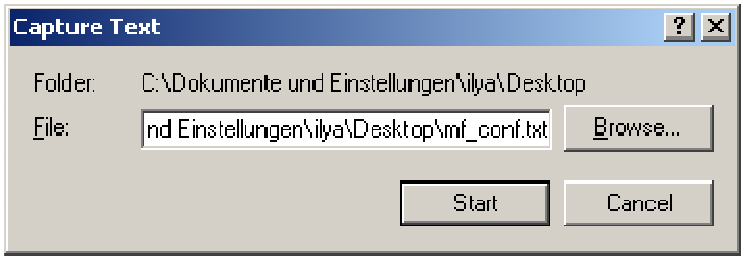
4.7.6.4 Storing a configuration with Hyper Terminal

A Hyper Terminal software is a popular terminal client that supports connection through serial interface or through Telnet protocol. It was included to Microsoft Windows 95, 98, ME, 2000 and XP, but it was discontinued in Windows Vista. If you have Hyper Terminal software you could store a MiniFlex configuration according to a step-by-step guide from this chapter.

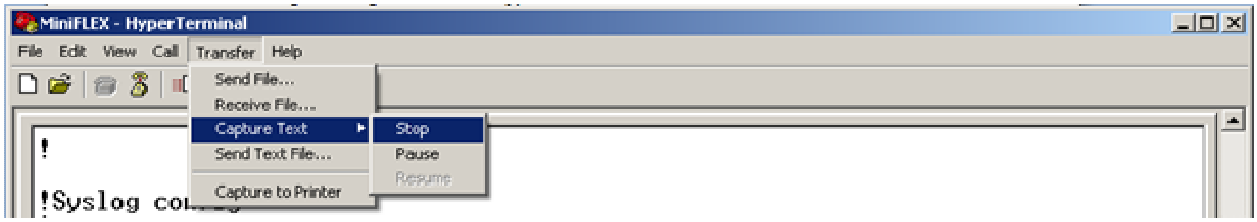
- Go to Transfer ---> Capture Text



- Select a file to save configuration, use txt extension for a file



- Click on Start to capture a screen output of a MiniFlex CLI
- Type a command from 4.7.6.1 - 4.7.6.3 to show desired configuration. Press any key so many times as needed until command prompt appears again.
- Go to Transfer ---> Capture Text ---> Stop and stop screen capturing



- Open a file you just saved and remove all unnecessary characters:
  - First line of a file should be:

    ```
    !FXOS system config file
    ```

  - Last line of a file should be:

    ```
    !End  of config
    ```

- Please remove **all** "`--Press any key to continue Ctrl+c to stop–`" messages from a file. Please keep a "`!Parameter`" string in the end of a line with "Press any key …" message. For example:

String before modification:

```
!Dot1x config
!

 --Press any key to continue Ctrl+c to stop--                    !Serp config
!
```

String after modification:

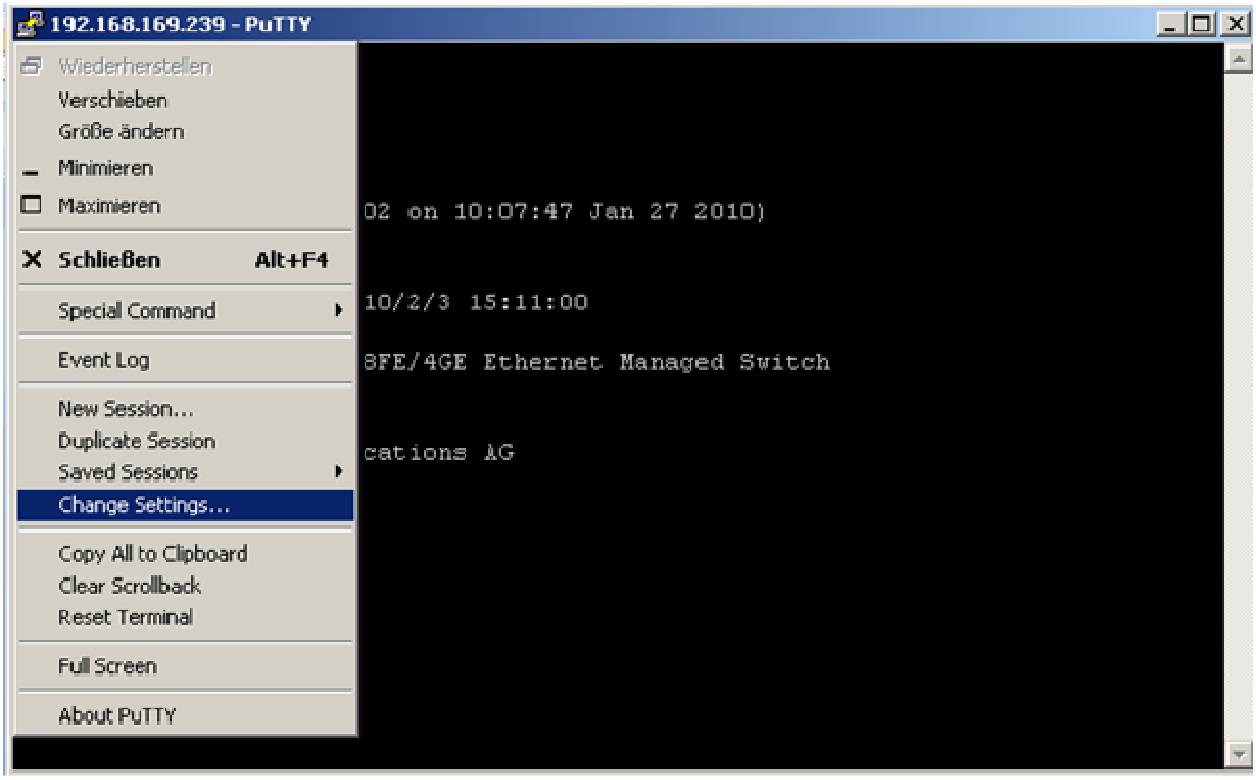
```
!Dot1x config
!

!Serp config
!
```

- Save file

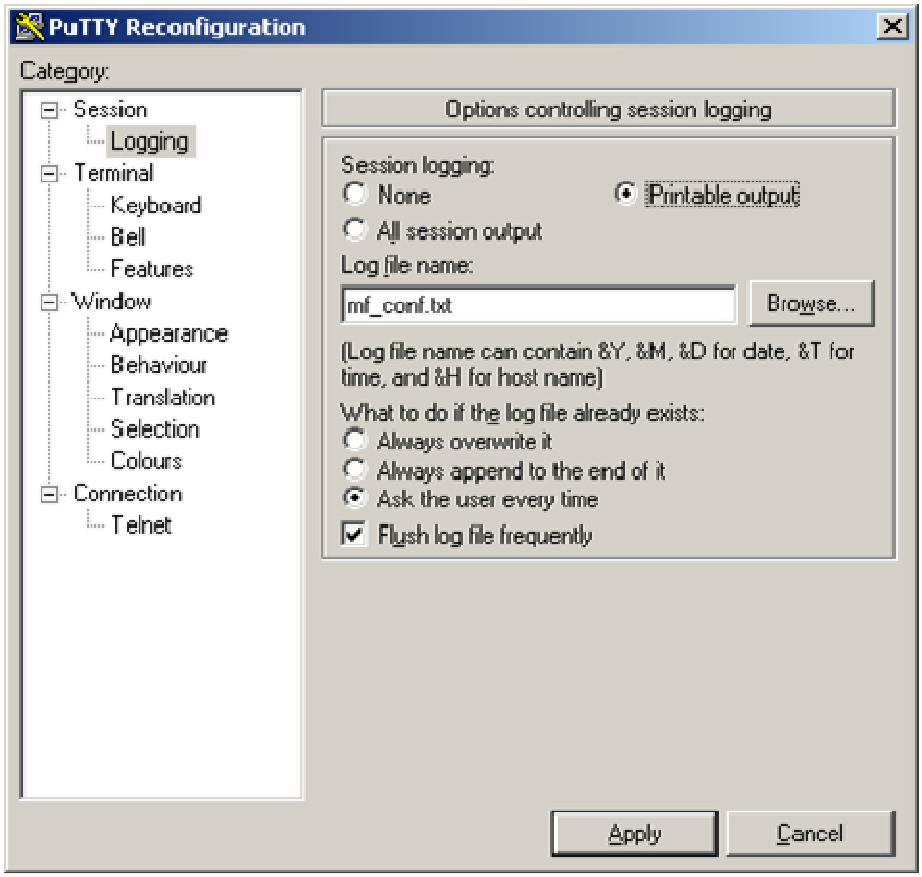
4.7.6.5 Storing a configuration with PuTTY

PuTTY is a freeware that supports serial connection as well as Telnet and SSH protocols. If you use PuTTY software you could store a MiniFlex configuration according to a step-by-step guide from this chapter.

- Click on PuTTY icon on the left top side of a window, click on change settings



- Click on Session ---> Logging and select log file name. Use txt extension for a file. Click on Printable Output and on Apply button.



- Type a command from 4.7.6.1 - 4.7.6.3 to show desired configuration. Press any key so many times as needed until command prompt appears again.
- Click on PuTTY icon again and select Change settings. Stop logging by selecting “None” under Session ---> Logging dialog.
- Open a file you just saved and remove all unnecessary characters:
  - First line of a file should be:

    ```
    !FXOS system config file
    ```
  - Last line of a file should be:

    ```
    !End  of config
    ```
  - Please remove **all** “`--Press any key to continue Ctrl+c to stop–`” messages from a file. Please keep a “`!Parameter`” string in the end of a line with “Press any key …” message. For example:

String before modification:

```
!Dot1x config
!

 --Press any key to continue Ctrl+c to stop--                    !Serp config
!
```

String after modification:

```
!Dot1x config
!

!Serp config
!
```

- Save file

4.7.7 Download a configuration to a switch

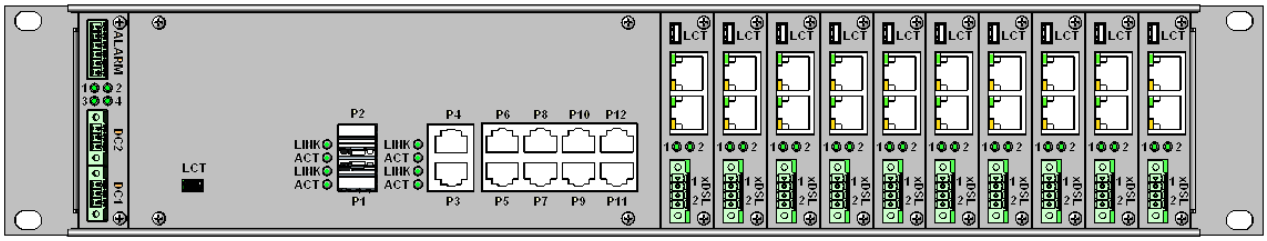
It is possible to download a previously saved configuration file from a PC to a switch with FTP protocol. To download please make sure that FTP server is running and accessible from a MiniFlex switch and run a command:

```
download ftp config <A.B.C.D> <user> <pass> <filename>
```

Please restart a switch for applying a downloaded configuration

4.8 Working with ports

Any Port of MiniFlex switch acts as Ethernet Port. It could be located on a front panel or directed to backplane. Please refer to a picture below.



Port number:	2	4	6	8	10	12	13	14	15	16	17	18	19	20	21	22
	1	3	5	7	9	11										

Figure 4.1 MiniFlex Port numbering

To configure any port a command ***interface ethernet 1/<port>*** is used. For example, to configure port number 12 type:

```
interface ethernet 1/12
FXOS(config-if-eth1/12)#
```

A command prompt shows that user enable a configuration mode of port 1/12.

To exit from port configuration mode type:

```
exit
FXOS(config)#
```

A full list of commands available in Port configuration mode is shown in Table 4-5.

#	Command	Description
1.	`access-list [enable|disable] <lists>`	Enables or disables an Access List on Ethernet interface. It is possible to add up to 63 lists with Access Control Rules to a port.
2.	`access-list [enable|disable] default`	Enables or disables a Default Access List on a port. Default Access list has only one rule: “Deny Everything” and it will be enabled automatically if any of Access Lists would be enabled. The meaning of “Default” Access List is to deny everything, and then to open some rules defined in other Access Lists.

3.	`access-list {[<1-63>|all]}*1`	Shows an information about defined Access List
4.	`auto [enable|disable]`	Enables or disables an Auto Negotiation of a port. Default state: Enabled
5.	`broadcast-rate [dlf|mcast|bcast|all] <0-1000000>`	Sets a broadcast limit for different types of broadcast packets in kbps. Broadcast packets are: DLF: Destination Lookup Fail MCAST: Multicast BCAST: Broadcast All: All of mentioned above
6.	`capable [10|100|1000]`	Configures a capability of Ethernet interface in Mbps
7.	`clear`	Clears screen
8.	`clear statistics`	Clears port statistics
9.	`description <string> {<string>}*29`	Creates a string (strings) with port description. You could use it, for example; to identify a connected user.
10.	`discard [untag |tag|all|none]`	This command tells which packets will be discarded upon receiving to a port: packets without VLAN tag, with tag, all or none
11.	`duplex [full|half]`	Configures duplex settings of a port. Please make sure that Auto negotiation is disabled before applying.
12.	`egress-rate <0-1000000>`	Configures an outgoing packets rate in kbps. Zero value disables rate limit.
13.	`exit`	Exits from port configuration mode
14.	`flowcontrol [enable|disable]`	Configures flow control settings of a port
15.	`help`	Shows help
16.	`ingress-rate <0-1000000>`	Configures an incoming packets rate in kbps. Zero value disables rate limit.
17.	`ip-vlan [enable | disable]`	Enables or disables an IP VLAN on a port. IP VLAN means that packets from defined subnet will be mapped to dedicate VLAN.
18.	`isolate from <portlist>`	Isolates current port from others. If port isolation function enabled, no traffic exchange is possible between isolated ports.
19.	`learning [enable|disable]`	This command enables or disables MAC address learning for a port. It is enabled by default
20.	`list`	List of available commands

21.	`list <string>`	List command that match a string
22.	`Logout`	Closes current session
23.	`mac-limit <0-16384>`	Sets a limit of MAC address to a port
24.	`mirror [ingress|egress] <portlist>`	Enables or disables incoming or outgoing mirror for selected ports
25.	`mirror ingress <portlist> egress <portlist>`	Enables or disables incoming or outgoing mirror for selected ports
26.	`no description`	Deletes a description of a port
27.	`no isolate`	Cancels port isolation function
28.	`no mirror`	Cancels port mirroring
29.	`no qos map [priority|dscp]`	Cancels QoS settings of a port
30.	`no shutdown`	Cancels port shutdown
31.	`ping {[-t]}*1 {[-count] <1-65535>}*1 <A.B.C.D>`	Performs ICMP requests with unlimited or limited (1 – 65535) attempts to defined IP address
32.	`port-bridge [enable|disable]`	Enables or disables a port bridge function. If enabled, packets will be returned back to the direction they were received from. This feature could be used for connecting of wireless base stations.
33.	`qos bandwidth <0-7> [<64-1024000>|0]`	Defines a bandwidth in kbps for a queue number 0 – 7. If 0 is selected, bandwidth control is disabled.
34.	`qos default-priority <0-7>`	Configures default QoS priority for a port
35.	`qos map dscp [enable|disable]`	Enables or disables a DSCP mapping to a queue
36.	`qos map dscp-priority <0-63> to <0-7>`	Map a DSCP enabled packet with specified marker to a queue number 0 – 7
37.	`qos map priority-queue <0-7> to <0-7>`	Map a 802.1p TOS priority to QoS priority queue
38.	`qos queue-weight <0-15> <0-15> <0-15> <0-15> <0-15> <0-15> <0-15> <0-15>`	Defines a WRR weight value for queues 0 to 7
39.	`qos sched-mode [pq|wrr]`	Selects a QoS method: Strict Priority or Wight Round Robin
40.	`quit`	Exits from port configuration mode
41.	`rspan tpid <0-65535> vlan-id <0-4095>`	Enables a remote mirror for TPID and VID. Default TPID for VLAN is HEX8100, DEC33024
42.	`show broadcast-rate {[dlf|mcast|bcast]}*1`	Shows a broadcast rate for dedicated group of packets
43.	`show default-priority`	Displays a default priority of a port
44.	`show discard`	Displays what packets are discarded on a

		port
45.	`show history`	Shows a history of commands
46.	`show interface ethernet {<portlist>}*1 {[statistics]}*1`	Displays an information about defined Ethernet interface and its statistics
47.	`show isolate`	Shows port isolation
48.	`show qos bandwidth {<0-7>}*1`	Displays a QoS bandwidth settings
49.	`show qos map [priority|dscp]`	Shows QoS mapping for TOS or DSCP markers
50.	`show queue-configurations`	Displays a queues scheduling mode
51.	`show rate-limit {[ingress|egress]}*1`	Shows a rate limit for incoming and outgoing packets in kbps
52.	`show running-config {[dhcp|dot1x|fdb|gvrp|interface|login-auth|nas|nms|radius-client|snmp|stp|syslog|usermanage]}*1`	Displays a running configuration of a whole system, or of defined part
53.	`show vlan-filter {[ingress|egress]}*1`	Displays a status of VLAN filter function of a port
54.	`show {[configuration|statistics]}*1`	Displays a configuration or statistics of a port
55.	`shutdown`	Shut down a port
56.	`speed [10|100|1000]`	Manually selects a speed of a port. Please make sure that Auto negotiation is disabled before applying.
57.	`trust [enable|disable]`	Enables or disables a trust function of a port. Trust function means that if it is enabled, all packets will be forwarded to respective VLAN in tagged or in untagged mode. If Trust function is disabled, all packets will be forwarded to Default VLAN. It is enabled by default
58.	`vlan-filter [ingress | egress] [enable|disable]`	Enables or disables VLAN filtering function for incoming and outgoing traffic. VLAN filter function means, that, if enabled, packet will be forwarded to VLAN a port belongs to. If unknown packet arrives, it will be blocked. On another hand, if VLAN filter is disabled a packet with undefined VID arrived, it will be forwarded according to a rule of VLAN with VID even if a port is not a member of this VLAN.
59.	`vlan-prefer[ip | mac]`	Sets which type of VLAN will be activated on a port: IP-subnet based or source MAC based.

Table 4-5. Commands to configure Ethernet interface

4.9 Working with VLAN

MiniFlex switch supports several types of VLANs. A user could create a VLAN based on criteria listed below:

- Physical port
- IEEE 802.1q tag
- IP Subnet
- Source MAC address

It is also possible to mix some of criteria, for example to create VLAN based on a port and tag.

Port-Based VLAN usually used to separate one group of ports from another group of ports. Each port works in **untagged** mode what means that normal PC or other Ethernet device could be connected to it. It is important to know that one port could belong to one VLAN only in Port-Based mode. A Port-Based VLAN terminated in single switch, i.e. two or more switches could not share same Port-Based VLAN.

VLAN Based on TAG has been defined in IEEE 802.1q standard and usually used to carry separate data over common media, e.g. over single Ethernet electrical, fiber or xDSL link. Because of a VLAN tag, a port could share several VLAN. Port works in **tagged** mode what means that only equipment with 802.1q support, i.e. another Switch or Server with tag-enabled network card must be connected to it. A TAG Based VLAN is not limited by single Switch; it could pass through full network.

A combination of Port-Based and TAG-Based VLAN is the mostly used method to connect two or more remote locations over single media. This method combines Ethernet ports worked in **untagged** and **tagged** mode. Untagged ports are used for subscriber's connection while tagged ports are used as common transmission media.

IP subnet-based VLAN is used to create VLAN only for devices which belong to defined IP subnet. It could be used, for example, to separate traffic from VoIP devices in common network and to give them better QoS and priority.

MAC-based VLAN is used to create VLAN for defined device (devices). It could be used to separate them from others or to give them special QoS.

4.9.1 Creating a Port-Based VLAN

In a default configuration of a MiniFlex Switch all it ports are combined into single Port Based VLAN with name **default**. This means that all ports can exchange information between each other.

Example: To create two port-based VLAN with names "research" and "operation" and add four ports into each. Ports 1/5-1/8 will be added into VLAN "research"; ports 1/9 – 1/12 will be added into VLAN "operation". VLAN "operation" will be used for switch management. It will have IP address 192.168.100.137.

#	Command	Description
1.	`FXOS(config)# interface vlan research`	Create VLAN "research"
2.	`FXOS(config-vlan-research)#add port 1/5-8 untagged`	Add ports 1/5 – 1/8 in untagged mode to a VLAN research
3.	`FXOS(config-vlan-research)#exit`	Exit from VLAN configuration

4.	`FXOS(config)# interface vlan operation`	Create VLAN “operation”
5.	`FXOS(config-vlan-operation)#add port 1/9-12 untagged`	Add ports 1/9 – 1/12 in untagged mode to a VLAN research
6.	`FXOS(config-vlan-operation)#exit`	Exit from VLAN configuration
7.	`FXOS(config)# management vlan operation`	Set VLAN “operation” as management VLAN
8.	`FXOS(config)# ip 192.168.100.137/24 gateway 192.168.100.254`	Set an IP address for a switch

Check a new configuration:

show interface vlan

```
FXOS(config)# show interface vlan
Interface VLAN default:

  Link status                    :Down
  Administrative status          :Up
  Vlan ID                        :1
  Vlan Type                      :Port-based
  Learn status                   :enable

  Port member list:
    eth1/1(u)      eth1/2(u)      eth1/3(u)      eth1/4(u)
    eth1/13(u)     eth1/14(u)     eth1/15(u)     eth1/16(u)
    eth1/17(u)     eth1/18(u)     eth1/19(u)     eth1/20(u)
    eth1/21(u)     eth1/22(u)

  Trunk member list:


Interface VLAN research:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :2
  Vlan Type                      :Port-based
  Learn status                   :enable

  Port member list:
    eth1/5(u)      eth1/6(u)      eth1/7(u)      eth1/8(u)

  Trunk member list:

Interface VLAN operation:

  Link status                    :Down
  Administrative status          :Up
  Vlan ID                        :3
  Vlan Type                      :Port-based
  IP Address                     :192.168.100.137/24
  Gateway                        :192.168.100.254
  Learn status                   :enable

  Port member list:
    eth1/9(u)      eth1/10(u)     eth1/11(u)     eth1/12(u)

  Trunk member list:

FXOS(config)#
```

4.9.2 Deleting a VLAN

To delete a VLAN a ***no interface vlan <vlan name>*** command is used

no interface vlan research

```
FXOS(config)# show interface vlan
Interface VLAN default:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :1
  Vlan Type                      :Port-based
  Learn status                   :enable

  Port member list:
    eth1/1(u)      eth1/2(u)      eth1/3(u)      eth1/4(u)
    eth1/5(u)      eth1/6(u)      eth1/7(u)      eth1/8(u)
    eth1/13(u)     eth1/14(u)     eth1/15(u)     eth1/16(u)
    eth1/17(u)     eth1/18(u)     eth1/19(u)     eth1/20(u)
    eth1/21(u)     eth1/22(u)

  Trunk member list:


Interface VLAN operation:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :3
  Vlan Type                      :Port-based
  IP Address                     :192.168.100.137/24
  Gateway                        :192.168.100.254
  Learn status                   :enable

  Port member list:
    eth1/9(u)      eth1/10(u)     eth1/11(u)     eth1/12(u)

  Trunk member list:

FXOS(config)#
```

4.9.3 Creating a TAG-based VLAN

To create a TAG-based VLAN and add ports into it a few commands should be executed in configuration mode.

Example: To create a TAG-based VLAN with name “research” and VID 100 and add four ports: 1/5 – 1/8 into it.

#	Command	Description
1.	`FXOS(config)# interface vlan research 100`	Create VLAN “research” with VID = 100
2.	`FXOS(config-vlan-research)#add port 1/5-8 tagged`	Add ports 1/5 – 1/8 in tagged mode to a VLAN research
3.	`FXOS(config-vlan-research)#exit`	Exit from VLAN configuration

Check a new configuration:

show interface vlan

```
FXOS(config)# show interface vlan
Interface VLAN default:
```

```
  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :1
  Vlan Type                      :Port-based
  IP Address                     :192.168.169.137/24
  Gateway                        :192.168.169.254
  Learn status                   :enable

  Port member list:
    eth1/1(u)      eth1/2(u)      eth1/3(u)      eth1/4(u)
    eth1/5(u)      eth1/6(u)      eth1/7(u)      eth1/8(u)
    eth1/9(u)      eth1/10(u)     eth1/11(u)     eth1/12(u)
    eth1/13(u)     eth1/14(u)     eth1/15(u)     eth1/16(u)
    eth1/17(u)     eth1/18(u)     eth1/19(u)     eth1/20(u)
    eth1/21(u)     eth1/22(u)

  Trunk member list:


Interface VLAN research:

  Link status                    :Down
  Administrative status          :Up
  Vlan ID                        :100
  Vlan Type                      :Port-based
  Learn status                   :enable

  Port member list:
    eth1/5(t)      eth1/6(t)      eth1/7(t)      eth1/8(t)

  Trunk member list:

FXOS(config)#
```

As you see, ports 1/5-8 belong to two VLAN: “default” and “research”. This means that, if untagged packet will arrive to a port, it will be forwarded to “default” VLAN. If tagged packet with VID=100 will arrive to a port, it will be forwarder to “research” VLAN.

4.9.4 Creating a Port and TAG-based VLAN

Please execute a command sequence in configuration mode to create VLAN consisted of tagged and untagged ports

Example: to create two VLAN: “research” (ports 1/5-8, untagged), “operation” (ports 1/9-12). VLAN “research” should have VID=100, VLAN “operation” should have VID=101. Ports 1/1-4 must be added to both VLAN in tagged mode. VLAN operation will be used as managed VLAN

#	Command	Description
1.	`FXOS(config)# interface vlan research 100`	Create VLAN “research” with VID = 100
2.	`FXOS(config-vlan-research)#add port 1/1-4 tagged`	Add ports 1/1 – 1/4 in tagged mode to a VLAN “research”
3.	`FXOS(config-vlan-research)#add port 1/5-8 untagged`	Add ports 1/5 – 1/8 in untagged mode to a VLAN research
4.	`FXOS(config-vlan-research)#exit`	Exit from VLAN configuration mode
5.	`FXOS(config)# int vlan operation 101`	Create VLAN “operation” with VID = 101

6.	`FXOS(config-vlan-operation)#add port 1/1-4 tagged`	Add ports 1/1 – 1/4 in tagged mode to a VLAN “operation”
7.	`FXOS(config-vlan-operation)#add port 1/9-12 untagged`	Add ports 1/9 – 1/12 in untagged mode to a VLAN “operation”
8.	`FXOS(config-vlan-operation)#exit`	Exit from VLAN configuration mode
9.	`FXOS(config)# management vlan operation`	Set VLAN “operation” as Management VLAN
10.	`FXOS(config)# ip 192.168.100.137/24 gateway 192.168.100.254`	Set an IP address and gateway for a switch

Check a new configuration:

show interface vlan

```
FXOS(config)# show interface vlan
Interface VLAN default:

  Link status                    :Down
  Administrative status          :Up
  Vlan ID                        :1
  Vlan Type                      :Port-based
  Learn status                   :enable

  Port member list:
    eth1/1(u)      eth1/2(u)      eth1/3(u)      eth1/4(u)
    eth1/13(u)     eth1/14(u)     eth1/15(u)     eth1/16(u)
    eth1/17(u)     eth1/18(u)     eth1/19(u)     eth1/20(u)
    eth1/21(u)     eth1/22(u)

  Trunk member list:


Interface VLAN research:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :100
  Vlan Type                      :Port-based
  Learn status                   :enable

  Port member list:
    eth1/1(t)      eth1/2(t)      eth1/3(t)      eth1/4(t)
    eth1/5(u)      eth1/6(u)      eth1/7(u)      eth1/8(u)

  Trunk member list:

Interface VLAN operation:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :101
  Vlan Type                      :Port-based
  IP Address                     :192.168.100.137/24
  Gateway                        :192.168.100.254
  Learn status                   :enable

  Port member list:
    eth1/1(t)      eth1/2(t)      eth1/3(t)      eth1/4(t)
    eth1/9(u)      eth1/10(u)     eth1/11(u)     eth1/12(u)

  Trunk member list:

FXOS(config)#
```

4.9.5 Creating an IP Subnet-based VLAN

It is possible to create a VLAN based on IP subnet. Please execute a list of commands for that purpose.

Example: to create IP Subnet-Based VLAN: “research” with Network 192.168.100.0/24 and VID=100 and add port 1/6 to it.

#	Command	Description
1.	`FXOS(config)# interface vlan research ip-subnet 192.168.100.0/24 100`	Create VLAN “research” with VID = 100 for a subnet
2.	`FXOS(config-vlan-research)#add port 1/6 untagged`	Add port 1/6 – 1/4 in untagged mode to a VLAN “research”
3.	`FXOS(config-vlan-research)#exit`	Exit from VLAN configuration mode
4.	`FXOS(config)# interface ethernet 1/6`	Enter to Port 1/6 configuration mode
5.	`FXOS(config-if-eth1/6)#ip-vlan enable`	Enable an IP Subnet Based VLAN on a port
6.	`FXOS(config-if-eth1/6)#exit`	Exit from port configuration

Check a new configuration:

show interface vlan

```
FXOS(config)# show interface vlan
Interface VLAN default:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :1
  Vlan Type                      :Port-based
  IP Address                     :192.168.0.254/24
  Gateway                        :192.168.0.253
  Learn status                   :enable

  Port member list:
    eth1/1(u)      eth1/2(u)      eth1/3(u)      eth1/4(u)
    eth1/5(u)      eth1/6(u)      eth1/7(u)      eth1/8(u)
    eth1/9(u)      eth1/10(u)     eth1/11(u)     eth1/12(u)
    eth1/13(u)     eth1/14(u)     eth1/15(u)     eth1/16(u)
    eth1/17(u)     eth1/18(u)     eth1/19(u)     eth1/20(u)
    eth1/21(u)     eth1/22(u)

  Trunk member list:


Interface VLAN research:

  Link status                    :Up
  Administrative status          :Up
  Vlan ID                        :100
  Vlan Type                      :IP-based
  Learn status                   :enable
  IP Subnet                      :192.168.100.0
  Network Mask                   :255.255.255.0

  Port member list:
    eth1/6(u)

  Trunk member list:
```

```
FXOS(config)#
```

Please note that Port 1/6 becomes a member of two VLAN: “default” and “research”. A PC connected to a port 1/6 has two IP addresses: 192.168.100.24/24 and 192.168.169.24/24. Packets that belongs to IP Subnet 192.168.100.0/24 will be forwarded according to the rules of VLAN “research” while packets from IP subnet 192.168.196.0/24 will be forwarded according to rules of VLAN “default”.

Check a Forwarding Database:

```
FXOS(config)# show fdb
FXOS(config)# sh fdb
--------  Begin of FDB Table Information ----------

VLAN name                 Mac address    Type        Interface   Queue
------------------------- -------------- ----------- ----------- ------
default                   000f.d904.4700 permanent   CPU         3
default                   0100.5e00.0001 mcast       CPU         0
default                   0090.f53e.7a0b dynamic     1/6         0
research                  0090.f53e.7a0b dynamic     1/6         0
default                   001c.c460.fbb8 dynamic     1/12        0
<-----------------------Skipped-------------------------------------->
default                   001c.c481.bfb8 dynamic     1/12        0
default                   0016.3537.2c09 dynamic     1/12        0
------------------------- -------------- ----------- ----------- ------

Total 16 MAC address filter entry showed.

----------  End of FDB Table Information ----------
FXOS(config)#
```

Port 1/6 has two entries in Forwarding Database.

4.9.6 Creating a MAC-Based VLAN

It is possible to create a VLAN based on source MAC address. This could be used for additional security and flexibility. MiniFlex Switch will forward a packet with defined MAC into special VLAN. It is possible to add up to 128 MAC address into VLAN.

Example: to create MAC Based VLAN: “research” with source MAC 0090.f53e.7a0b connected to port 1/6 with VID=100.

#	Command	Description
1.	`FXOS(config)# interface vlan research 100`	Create a VLAN “research” with VID 100
2.	`FXOS(config-vlan-research)#add port 1/6 untagged`	Add port 1/6 in untagged mode
3.	`FXOS(config-vlan-research)#exit`	Exit from VLAN configuration mode
4.	`FXOS(config)# mac-vlan add 0090.f53e.7a0b vlan research`	Add a MAC address to VLAN “research”
5.	`FXOS(config)# mac-vlan enable 1/6`	Enable a MAC VLAN on port 1/6

To delete MAC based VLAN, a customer need to delete assigned MAC address first a command ***mac-vlan delete [<H.H.H> ¦ all]*** used for this.

4.9.7 A list of commands related with plain VLAN

A full list of commands used for VLAN configuration is shown in Table 4-6.

#	Command	Description
1.	`show interface vlan {vlan name}*1`	Displays an information about all VLAN or about defined VLAN
2.	`interface vlan <vlanname> {<1-4094>}*1`	Creates a VLAN with "vlanname" and optionally defined VID. Command Line Goes to VLAN configuration mode.
3.	`interface vlan <vlanname> ip-subnet <A.B.C.D/M> {<1-4094>}*1`	Creates a IP-Subnet based VLAN with defined "vlanname", IP subnet and optionally defined VID. Command Line Goes to VLAN configuration mode.
4.	`mac-vlan [enable|disable] [<portlist>|all]`	Enables MAC based VLAN for defined ports
5.	`mac-vlan add <H.H.H> vlan <name> {priority <0-7>}*1`	Adds a MAC entry to defined VLAN with defined priority.
6.	`mac-vlan delete [<H.H.H>|all]`	Deletes a defined MAC entry or all entries from MAC based VLAN
7.	`show mac-vlan`	Displays an information about MAC-based VLAN
8.	`management vlan <vlanname>`	Sets a VLAN "vlanname" as management VLAN
9.	`no interface vlan <vlanname>`	Deletes a VLAN "vlanname"
#	**Commands in VLAN configuration mode**	**Description**
10.	`[add|delete] port <portlist> [tagged|untagged]`	Adds or deletes a port (a list of ports) into VLAN in tagged or untagged mode
11.	`[add|delete] trunk <trunkname> [tagged|untagged]`	Adds or deletes a Trunk with "trunkname" into VLAN with tagged or untagged mode
12.	`clear`	Clears screen
13.	`description <string> {<string>}*29`	Adds a description to VLAN
14.	`exit`	Exits from VLAN configuration mode
15.	`help`	Shows Help
16.	`learn [enable | disable]`	Enables or disables MAC address learning for a VLAN. It is enabled by default.
17.	`list {<string>}*1`	Shows a list of all commands or only commands that contains defined string.
18.	`no description`	Deletes a VLAN description
19.	`pfm [drop | flood | all]`	Configures a VLAN multicast filtering

		function. All: all Multicast packets will be forwarded into this VLAN Drop: Unknown Multicast packets will be dropped Flood: Unknown Multicast packets will be forwarded into this VLAN
20.	`logout`	Closes a session
21.	`quit`	Closes a session
22.	`show interface vlan {vlan name}*1`	Displays an information about all VLAN or about defined VLAN

Table 4-6. Commands to configure VLAN interface

4.10 Forwarding Database

All network devices have MAC address to uniquely identify themselves. These addresses are used for data transmission; each Ethernet packet has MAC address of source and destination. A plain Layer 2 Ethernet switch creates a forwarding database (FDB) and stores this information in it:

- Port number
- Egress MAC address

Upon receiving a packet, a switch looks into FDB and checks if destination MAC address exists. If FDB has a record with destination MAC address, a packet will be forwarded to an egress port.

MiniFlex is not a plain Layer 2 Ethernet switch, it has VLAN functionality. It means that same port could carry several VLAN. A FDB entry could be dynamical, permanent or used by System, so a MiniFlex FDB has following entries:

- Egress interface (Port or Trunk)
- Egress MAC address
- VLAN name a MAC address belongs to
- Type of entry (static, dynamic or system)

A FDB table can store up to 16384 records with default aging time equal to 300 seconds. Default system settings allow storing of every new entry in FDB. A list of commands related with FDB is shown in Table 4-7.

#	Command	Description
1.	`fdb agingtime [ 0 | <1-3600>]`	Selects an FDB aging time in seconds. If 0 is selected then an entry will not be aged. Default value is 300 seconds
2.	`fdbentry mac <H.H.H> vlan <name> <slot/port> {queue <0-7>}*1`	Manually adds a MAC address and binds it to VLAN, port with selected priority queue.
3.	`fdbentry mac <H.H.H> vlan <name> <trunkname> {queue <0-7>}*1`	Manually adds a MAC entry to Trunk interface with selected queue
4.	`fdbentry mac <H.H.H> vlan <name> drop`	Writes an entry into black list. All packets will be dropped from this address
5.	`no fdb agingtime`	Deletes an aging time settings and

		restores default settings
6.	`no fdbentry drop mac <H.H.H> vlan <name>`	Removes an entry from black list
7.	`no fdbentry mac <H.H.H> vlan <name>`	Removes a permanent entry from FDB
8.	`show fdb agingtime`	Shows a FDB aging time settings
9.	`show fdb drop`	Shows a list of entries to drop packets from (a black list)
10.	`show fdb {[count]}*1 {[dynamic|permanent|mcast]}*1 {[port|trunk] <name>}*1 {[mac] <H.H.H>}*1 {[vlan] <name>}*1`	Shows FDB entries: dynamic, permanent, multicast, by MAC, VLAN

Table 4-7. Commands to configure FDB

4.11 Rapid Spanning Tree

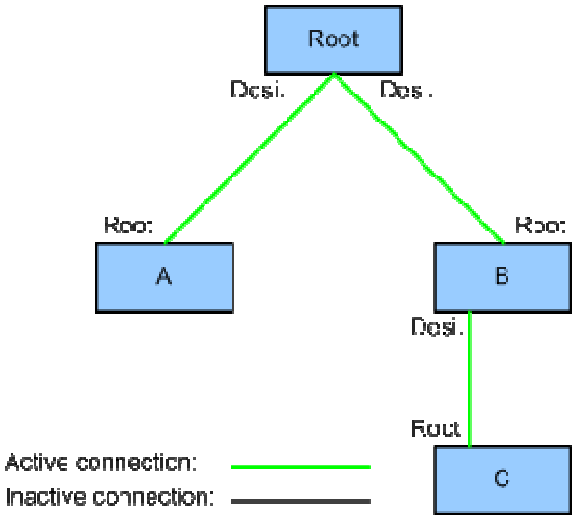
Rapid Spanning Tree Protocol (RSTP) is based on IEEE 802.1w standard. It used for dynamic link switching in networks with ring topology. The ring topology improves reliability of data networks; nevertheless Ethernet networks must have only one active path between any of two nodes to prevent packet loop. Ethernet switches with enabled RSTP detect paths availability in a ring and quickly select active path, discarding other paths. All RSTP-enabled devices exchange information about topology change in so-called BPDU packets.

Root Bridge

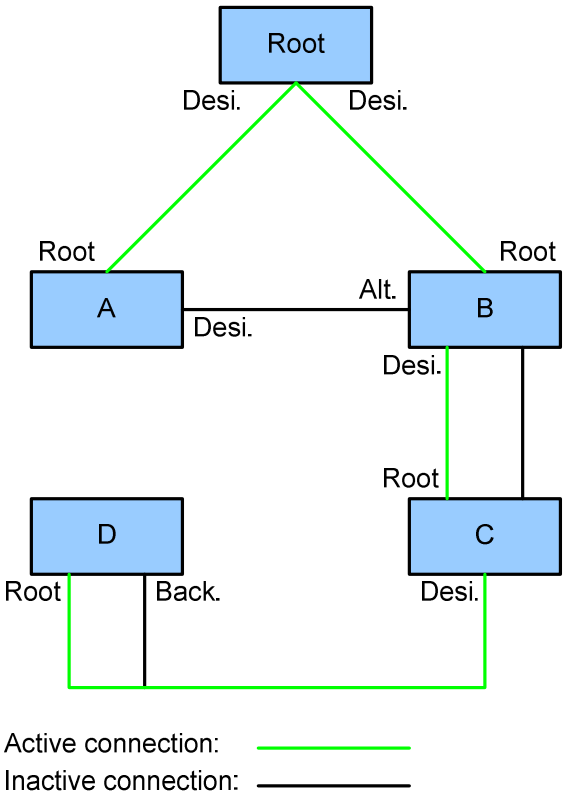
One switch in a RSTP-enabled network must acts as Root Bridge. Root Bridge selection will be done automatically according to Bridge ID – a unique ID that each member of RSTP network has. Bridge ID is a combination of Switch MAC address and Bridge Priority. Switch with smallest Bridge Priority will act as Root Bridge. If two or more switches have same priority, Switch with less MAC address will become Root Bridge.

Port Roles

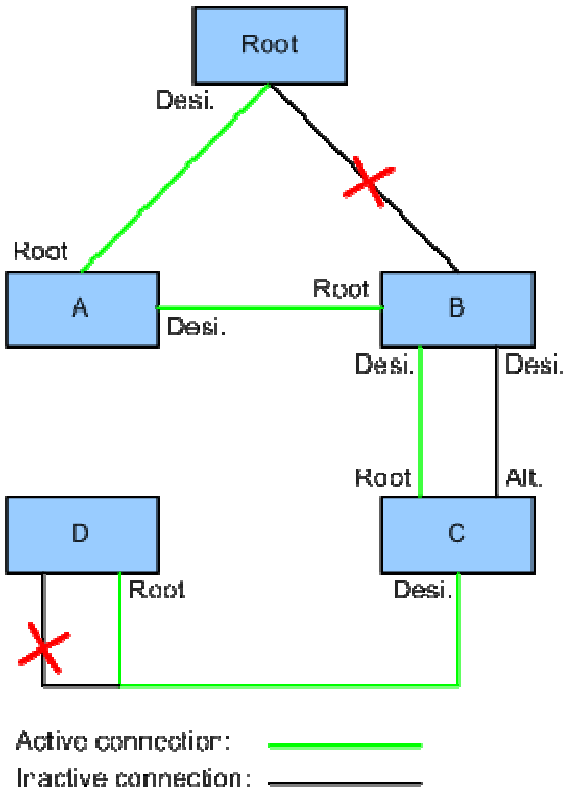
After Root Bridge has been selected, other switches define their ports behavior. The port that has the shortest path to Root Bridge will become Root Port. The opposite port on the other switch will become Designated Port. The Root Bridge has Designated Ports only, while other switches have one Root port and could have Designated Port connected to other switches like it is shown on picture below:



A Root and Designated ports are active, they learn and Forward packets. Other ports have blocking state. They could act as Alternate port or as Backup port. Please take a look on below picture for reference:



If active path will not be present any more, the second path will be automatically selected.



RSTP configuration must be done in accordance with a following schedule:

- Enabling or disabling a RSTP function for a switch
- Enabling or disabling a RSTP function for an interface (Trunk or Port)
- Configuring a RSTP parameters

A list of RSTP related commands is shown in Table 4-8.

#	Command	Description
1.	`spanning-tree mode [cst|mst]`	Select a Spanning Tree Protocol operation mode: Common Spanning Tree or Multiple Spanning Tree
2.	`show running-config stp`	Shows current Spanning Tree Configuration
3.	`config spanning-tree`	Enters into Spanning Tree Configuration Mode

4.	`show spanning-tree`
	`show spanning-tree mst <0-30>`
	`show spanning-tree mst port <sl/port>`
	`show spanning-tree mst summary`
	`show spanning-tree mst trunk <trunkname>`
	`show spanning-tree port <slot/port>`
	`show spanning-tree trunk <trunkname>`
		Shows Spanning Tree configuration for port or trunk interface; for CST or for MST

#	**Commands in Spanning Tree configuration mode**	**Description**
5.	`debug spanning-tree`	Starts a debugging for some parameters: all, bridge, edge, info, migrate, p2p, pcost, rolesel, roletrans, sttrans, topoch, transmit Parameters
6.	`exit`	Exits from STP configuration mode
7.	`no debug spanning-tree`	Stops STP debugging
8.	`no spanning-tree [forward-delay | hello-time | maximum-age |priority]`	Resets a STP parameters to default
9.	`no spanning-tree port <slot/port> [edge | non-stp | p2p |path-cost |priority]`	Resets a STP parameters of a port to default
10.	`no spanning-tree trunk <trunkname> [path-cost|priority|non-stp |p2p|edge]`	Resets a STP parameters of a trunk to default
11.	`show debug spanning-tree`	Shows a debug information
12.	`show spanning-tree port <slot/port>`	Shows an STP information of a port
13.	`show spanning-tree trunk <trunkname>`	Shows an STP information of a trunk
14.	`spanning-tree [enable|disable]`	Enables or disables a STP for a switch
15.	`spanning-tree [forward-delay] <4-30>`	Sets a forward-delay interval in seconds. This parameter indicates a time period while a port will be in listening and learning

		state, i.e. will build an FDB table. When a forward-delay period will be over, a port will turn into forwarding state. Default value is 15 seconds.
16.	`spanning-tree [hello-time] <1-10>`	Sets a time period “hello-time”. This period indicates that BPDU packet will be send every “hello-time”. Default value is 2 seconds.
17.	`spanning-tree [maximum-age] <6-40>`	Sets a maximum-age interval. This interval is used to detect that data path is defected. Data path could become defected if three consecutive BPDU packets were not reached, or if “maximum-age” time counter expires. Default maximum-age time is 20 seconds.
18.	`spanning-tree [priority] <0-61440>`	Sets a priority for STP-enabled switch. Switch with lower STP priority value will become a root in RSTP enabled network. Default switch priority is 32768. If all switches in a network have same default priority settings, a switch with lower MAC address will be selected as a root. STP priority must be multiple of 4096
19.	`spanning-tree [port <slot/port> | trunk <trunkname>] [edge] [yes | no]`	Selects an Edge attribute for an interface. If selected, a port will not participate in RSTP tree construction. Upon receiving a BPDU packed to a port with Edge attribute it will become a normal port and will participate in RSTP tree construction. Edge ports must be connected to terminal stations.
20.	`spanning-tree [port <slot/port> | trunk <trunkname>] [non-stp] [yes | no]`	Selects if an interface will participate in RSTP network construction or not.
21.	`spanning-tree [port <slot/port> | trunk <trunkname>] [p2p] [yes | no | auto]`	Selects a P2P attribute for an interface. A PTP attribute could be activated for an interface that is connected to another switch.
22.	`spanning-tree [port <slot/port> | trunk <trunkname>] [path-cost] [auto |<1-200000000>]`	Selects a path cost for an interface. A path with lower cost will be selected for data transmission.
23.	`spanning-tree [port <slot/port> | trunk <trunkname>] [priority] <0-240>`	Selects a priority for an interface. In interface with lower priority will be selected as root port. Default priority value is 128 and it must be multiple to 16.

Table 4-8. Commands to configure RSTP

The values for Hello-time, Max-Age and Forward-Delay must meet the following rule:
2*(Hello-time + 1) <= Max-Age <= 2*(Forward-Delay - 1)

4.12 Link Aggregation Control Protocol

A Link Aggregation Control Protocol (LACP) is based on IEEE 802.3ad and used to activate dynamic link aggregation and de-aggregation between two peers by sending a LACPDU (link Aggregation Control Protocol data Units).

A LACP could be activated between two nodes if one node will be configured in Active mode while the other node should work in Passive mode.

A list of LACP related commands is shown in Table 4-9

#	Command	Description
1.	`config lacp [enable|disable]`	Enables or disables a LACP for a node
2.	`config lacp port <portlist> mode [active|passive|off]`	Adds port (ports) into trunk with Active (will send LACPDU) or Passive mode. Deletes port (ports) from a trunk.
3.	`config lacp system-priority <0-65535>`	Configures a system priority. It is an optional value. Default is 32768. Higher values represent lower priority.
4.	`config lacp port <portlist> priority <0-255>`	Optionally sets a priority for a port (ports)
5.	`config lacp port <portlist> key <0-1023>`	Optionally sets a LACP administrative key.
6.	`show interface trunk`	Displays active trunk status.
7.	`show running-config lacp`	Displays active trunk configuration

Table 4-9. Commands to configure LACP

4.13 Trunks

Trunks are used to enhance a throughput between two Ethernet switches by combining of several Ethernet interfaces into single bundle. Both peers must have same group configuration to prevent Ethernet data loops. One port in a group acts as “Master” port. It must be in operational state while trunk group creation. A port with lower number will become a “Master” port.

A list of Trunk related commands is shown in Table 4-10

#	Command	Description
1.	`interface trunk <trunkname>`	Creates a Trunk interface with “Trunkname”
2.	`no interface trunk <trunkname>`	Deletes a Trunk Interface “Trunkname”
3.	`show interface trunk {<trunkname>}*1 {[statistics]}*1`	Shows information about a Trunk or its statistics
4.	`show trunk-policy`	Show Trunk Policy
5.	`trunk-policy [dmac-based|smac-based|dmac-smac-based|dip-based|sip-`	Sets a Trunk policy: Destination MAC, Source MAC, Destination IP, Source IP

	based|dip-sip-based]	
#	**Commands in Trunk configuration mode**	**Description**
6.	clear	Clears screen
7.	clear statistics	Clears interface statistics
8.	description <string> {<string>}*29	Adds a description to an interface
9.	exit	Exits from Trunk configuration mode
10.	grouping <portlist>	Adds ports to a Trunk group. It is possible to have 2 Trunk groups with up to 8 ports in each
11.	mac-limit <0-16384>	Sets a MAC limit for an interface
12.	no description	Deletes an Interface description
13.	no grouping	Deletes ports from Trunk group

Table 4-10. Commands to configure Trunk

4.14 Switch Ethernet Ring Protection

A Switch Ethernet Ring Protection (SERP) mechanism improves performance of Ethernet rings. Unlike STP/RSTP rings, a SERP enabled network allows rapid loop protection and path convergence with time period less than 1 sec. Most networks could have convergence time less than 50 msec. SERP protocol doesn't limit a number of nodes in a ring and doesn't increase a protection switching time with increasing of nodes in a ring.

Concept

All nodes working in a SERP enabled ring share same ***Domain***. A node could act as ***Master*** node or as ***Transit*** node. One node in a ring becomes a Master node, other acts as Transit nodes. Every node is connected to a ring with two ports: ***Primary Port*** and ***Secondary Port***. Primary Port of Master node used to forward traffic, while Secondary port of Master node works in blocking state. A Primary and Secondary ports of Transit nodes work in forwarding state. A secondary port of a node should be connected to a primary port of previous node. And so on and so forth in a ring.

A Master node checks a ring health with ***Control VLAN***. Please add only primary and secondary ports of every node into it to achieve fastest switching time. An interval between Control VLAN data units is user selectable. On the other hand a ***Protected VLAN*** is used to carry time sensitive data traffic. SERP examples are shown on Figure 4.2 and Figure 4.3

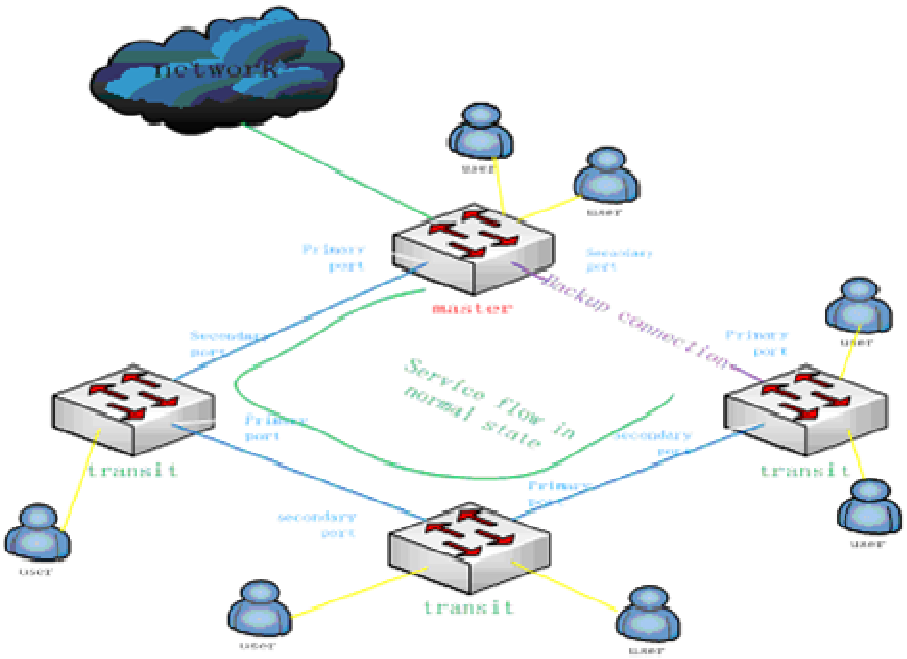


Figure 4.2. SERP concept: normal mode

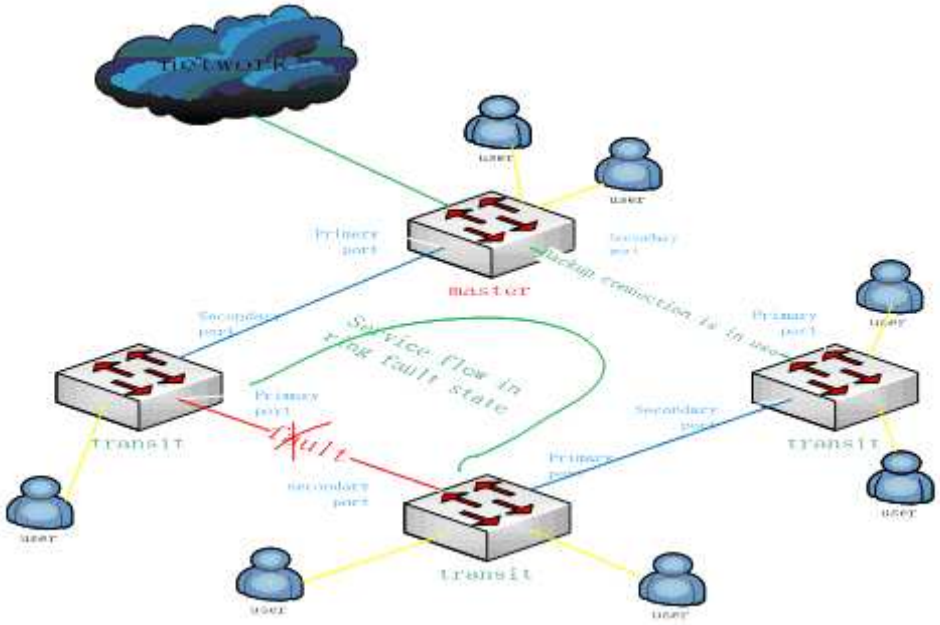


Figure 4.3. SERP concept: failure appears

A list of SERP related commands is shown in Table 4-11

#	Command	Description
1.	`config serp`	Opens a SERP configuration submenu
2.	`show running-config serp`	Shows SERP Running Configuration
3.	`show serp domain {[<name>]}*1`	Show SERP domain information
#	**Commands in SERP configuration mode**	**Description**
4.	`serp [enable|disable]`	Enables or Disables SERP

5.	`create serp domain <name> {<1-1>}*1`	Create SERP domain "Name" with optional ID. It is only one domain supported with current firmware.
6.	`config serp domain <name> [enable|disable]`	Enables or disables SERP domain.
7.	`config serp domain <name> mode [master|transit]`	Sets a Role for a Node in SERP domain
8.	`config serp domain <name> add control_vlan <name>`	Adds a Control VLAN into SERP domain
9.	`config serp domain <name> delete control_vlan`	Deletes a control VLAN from SERP domain
10.	`config serp domain <name> [add|delete] protected_vlan <name>`	Adds or deletes protected VLAN into or from SERP domain
11.	`config serp domain <name> add [primary_port|secondary_port] <slot/port>`	Adds primary or secondary port into SERP domain
12.	`config serp domain <name> delete [primary_port|secondary_port]`	Deletes a primary or secondary port from SERP domain
13.	`config serp domain <name> [hello_time|hello_fail_time] <time>`	Sets a timing interval for keep alive messages inside Control VLAN. A <time> parameter must follow the rule: 1<=hello time*3<=hello fail time<=500 1 represents 100ms
14.	`config serp domain <name> upflush_fail_time <time>`	Configures an SERP domain upflush fail time
15.	`no config serp domain <name> [hello_time|hello_fail_time]`	Restores default timing settings for hello time and for hello fail time
16.	`no config serp domain <name> upflush_fail_time`	Restores default timing settings for upflush fail time
17.	`no create serp domain <name>`	Deletes a SERP domain

Table 4-11. Commands to configure SERP

4.15 IGMP Snooping

The IGMP Snooping feature helps to reduce unnecessary traffic in IP Multicast network scenarios. In general IP Multicast was designed to reduce network load due to the fact that several users could share same stream from multimedia server, for example IPTV stream. In that case only users that have correct subscription would receive data while other will be blocked. However because IP Multicast runs on Layer 3 level and there are no Layer 2 multicast control protocols exist, a switch has to build own Layer 2 forwarding database from a IP Multicast headers. This translation is called IGMP Snooping.

A list of IGMP Snooping related commands is shown in Table 4-12

#	Command	Description
1.	`igmp-snooping [enable|disable]`	Enables or disables IGMP Snooping
2.	`igmp-snooping addmemberport <slot/port> vlan <vlanname>`	In order to realize the IGMP protocol for a specified VLAN, it is possible to add a

		static multicast member port
3.	`igmp-snooping addmemberport trunk <trunkname> vlan <vlanname>`	In order to realize the IGMP protocol for a specified TRUNK, it is possible to add a static multicast member port
4.	`igmp-snooping addqueryport <portlist>`	IGMP Snooping query is used in networks where IGMP and PIM are not implemented because Multicast traffic has not to be routed. After the IGMP Snooping query will be enabled on a switch, it will sends out IGMP queries that will trigger the ports on listening switch (with IGMP snooping enabled). The IGMP Snooping enabled switch will trigger ports depending on these queries. There must be only one switch in a VLAN that will send IGMP query. The command adds port or ports to query send list.

5.	`igmp-snooping addqueryport trunk <trunkname>`	The command adds TRUNK to query send list.
6.	`igmp-snooping addrouter <slot/port> vlan <name>`	Manually adds IGMP or PIM router to desired port and VLAN
7.	`igmp-snooping addrouter trunk <name> vlan <name>`	Manually adds IGMP or PIM router to desired TRUNK
8.	`igmp-snooping delete all`	Deletes all IGMP Snooping configuration
9.	`igmp-snooping delete vlan <name> group [<A.B.C.D>|all]`	Deletes Multicast group A.B.C.D or ALL groups from VLAN
10.	`igmp-snooping delmemberport <slot/port> vlan <name>`	Manually deletes member port
11.	`igmp-snooping delmemberport trunk <trunkname> vlan <vlanname>`	Manually deletes member TRUNK
12.	`igmp-snooping delqueryport trunk <trunk>`	Deletes query TRUNK
13.	`igmp-snooping delqueryport <portlist>`	Deletes query port
14.	`igmp-snooping delrouter <slot/port> vlan <name>`	Deletes Multicast router from port and VLAN
15.	`igmp-snooping delrouter trunk <name> vlan <name>`	Deletes Multicast router from a TRUNK
16.	`igmp-snooping grouplife [<10-1000>|default]`	Sets IGMP Snooping aging time. Default is 250 seconds
17.	`igmp-snooping queryinterval [<10-300>|default]`	Sets IGMP common query interval. Default is 125 seconds
18.	`igmp-snooping responsetime [<10-25>|default]`	Set IGMP Snooping response time. Default is 10 seconds
19.	`igmp-snooping robust [<1-100>|default]`	Set IGMP Snooping specific query interval. Default is 2 seconds
20.	`igmp-snooping routerlife [<20-600>|default]`	Set IGMP Snooping router aging time. Default is 250 seconds
21.	`show igmp-snooping`	Displays actual IGMP Snooping information
22.	`show igmp-snooping grouplife`	Shows IGMP Snooping group aging time
23.	`show igmp-snooping hosttimeout`	Shows IGMP host aging time
24.	`show igmp-snooping memberport`	Shows IGMP Snooping members
25.	`show igmp-snooping queryinterval`	Shows IGMP standard query interval
26.	`show igmp-snooping queryport`	Shows IGMP query port
27.	`show igmp-snooping responsetime`	Shows IGMP Snooping response time
28.	`show igmp-snooping robust`	Shows IGMP specific query interval
29.	`show igmp-snooping router`	Shows IGMP router

30.	`show igmp-snooping routerconfig`	Shows IGMP Snooping router configuration
31.	`show igmp-snooping routerlife`	Show IGMP Snooping router aging time

Table 4-12. Commands to configure IGMP Snooping

4.16 Multicast VLAN registration

Multicast VLAN Registration (MVR) is a technology that can be used as an alternative to Protocol Independent Multicast (PIM) to create large Multicast Networks for IPTV providers. In Ethernet networks sending multiple multicast streams to several receivers in separate VLANs will cause traffic multiplication because each VLAN will carry same traffic. The Multicast VLAN Registration allows sharing Multicast data between several subscribers VLAN without affecting their private data.

In general MVR technology is similar to IGMP Snooping. Both technologies listen to Multicast messages (Join and Leave) and build Layer 2 forwarding database respectively. The difference between IGMP Snooping and MVR is that IGMP Snooping can work over dedicated VLAN, while MVR can work with hosts over different VLANs over Layer 2 network.

Both MVR and IGMP Snooping technologies can coexist in one switch. In case if MVR and IGMP Snooping are enabled on a switch, a MVR will react on join and leave messages from Multicast groups configured under MVR.

The MiniFlex Switch supports MVR static and MVR dynamic operational modes.

In static mode, a multicast data received by MVR-enabled host, will be forwarded to all MVR-enabled user ports if these ports are configured as MVR receiver and are added into the multicast group with defined VLAN. The multicast data will be forwarded only to MVR-enabled ports that were statically configured. IGMP messages received from MVR-enabled hosts will never been forwarded from MVR data ports that were statically configured.

In dynamic mode, the multicast data received by MVR-enabled hosts will be forwarded only to those MVR user ports that have been joined a group ether by IGMP messages or by MVR static configuration. IGMP messages received from MVR-enabled hosts will never been forwarded from MVR data ports that were statically configured.

You must configure a port with defined VLAN as MVR receiver. No MVR receiver ports exist in a switch by default. The MVR receiver must not belong to MVR VLAN.

Important knowledge about Multicast VLAN Registration

- Only one MVR VLAN is supported
- If VLAN is destined for MVR VLAN, all ports in this VLAN shouldn't belong to any other VLAN
- MVR receivers (user ports) could be in different VLAN but they shouldn't belong to MVR VLAN
- an MVR receiver can be neither IGMP Snooping router port nor IGMP Snooping member
- The maximum number of multicast entries (MVR group addresses) that can be configured on a switch is 256
- You should enable IGMP Snooping before setting MVR to dynamic mode. The warning message will be displayed otherwise.
- You can't delete a VLAN with ***`no interface vlan <vlanname>`*** command if it is a MVR VLAN. You have to cancel the MVR feature on it firstly with ***`delete mvrvlan <vlanname>`*** command.
- If VLAN has MVR receivers you have to delete them before deleting a VLAN. Otherwise a warning message will be shown.

A list of Multicast VLAN Registration related commands is shown in Table 4-13.

#	Command	Description
1.	`show running-config mvr`	Shows active MVR running config
2.	`config mvr`	Enters to a MVR configuration mode
3.	`enabled`	Enables MVR feature
4.	`disabled`	Disables MVR feature
5.	`mvr mode [static|dynamic]`	Configures MVR static or dynamic mode of operation
6.	`add receiver port <portlist> {vlan <vlanname>}*1`	Before using a MVR function you must add ports as MVR receiver. You could add ports only once. Use <portlist> and VLAN name to specify the source. If VLAN parameter is missed then MVR function will listen all VLAN a port belongs to
7.	`mvr vlan <vlanname>`	Configures VLAN with defined <vlanname> as MVR VLAN. After entering this command, a CLI will go to MVR VLAN configuration mode.
8.	`add group <A.B.C.D> sport <slot/port> sip <A.B.C.D> {count <1-256>}*1`	In MVR VLAN configuration mode you must configure one or more (up to 256) multicast groups. A.B.C.D is a multicast group IP; sport is source port; sip is source IP
9.	`add user port <portlist> vlan <vlanname> group <A.B.C.D> {sip <A.B.C.D>}*1`	In MVR VLAN configuration mode you must add user ports <portlist>and connect them to multicast group with A.B.C.D IP address. Optionally it is possible to set source IP <sip>
10.	`delete group <A.B.C.D> sport <slot/port> sip <A.B.C.D> {count <1-256>}*1`	In MVR VLAN configuration mode this command deletes multicast group
11.	`delete user port <portlist> vlan <vlanname> group <A.B.C.D> {sip <A.B.C.D>}*1`	In MVR VLAN configuration mode this commands deletes user ports
12.	`exit`	Exits MVR VLAN configuration mode back to MVR configuration mode
13.	`no mvr vlan <vlanname>`	Cancels MVR VLAN. The VLAN <vlanname> will not be deleted.
14.	`show mvr {vlan <vlanname>}*1`	Shows information about MVR VLAN <vlanname>
15.	`show receiver {port <slot/port>}*1`	Shows receiver information
16.	`exit`	Exist from a MVR configuration mode

Table 4-13. Commands to configure Multicast VLAN Registration

4.17 Multiple Spanning Tree Protocol

The Multiple Spanning Tree Protocol was defined in IEEE 802.1s standard and later was merged in IEEE 802.1Q – 2003. It has backward compatibility with IEEE 802.1d STP and IEEE 802.1w rapid Spanning Tree and allows construction of several spanning tree instances in several VLANs. Each of VLAN could have own spanning tree topology.

In general MSTP could be used for load balancing and for construction of large networks with high reliability therefore the failure in single instance of STP will not affect other STP instances.

Important knowledge about MSTP

- MSTP allows usage of several legacy STP instances in IEEE 802.1q enabled network
- VLANs could belong to different STP instances
- Each STP instance inside MSTP uses RSTP protocol for best convergence
- MSTP Region
    - A group of interconnected switches with same MSTP configuration organize an MSTP region
    - MSTP advantages could be used inside of a same region. Two or more regions have same Spanning Tree instance for all VLANs
    - To create a region all switches must have same:
        - Configuration name
        - Configuration Revision Number
        - VLAN to STP instances (STPI) map
- It is important to set MSTP protocol manually because RSTP is used by default
- It is important to set root switch for MSTP tree

A list of MSTP related commands is shown in Table 4-14.

#	Command	Description
1.	`spanning-tree mode [cst|mst]`	Set spanning tree working mode. Default is common spanning tree (RSTP). You need to set it mst (Multiple Spanning Tree) manually
2.	`config spanning-tree`	Enters to a STP configuration mode
3.	`spanning [enable|disable]`	Enables or disables spanning tree protocol support for a switch
4.	`spanning-tree mst name <name>`	Set name for MSTP copy. Name could have up to 32 characters.
5.	`spanning-tree mst revision <0-65535>`	Set the MSTP revision number
6.	`spanning-tree map vlan <vlanlist> mst <0-30>`	Map VLAN <vlanlist> for an MSTP Instance (0 – 30). <vlanlist> is a simple list, for example: for example:"1","1,2","1-10,13". If MST Instance is set to 0 the standard RSTP protocol will be used. It is compatibility mode.
7.	`spanning-tree priority <0-61440> mst <0-30>`	Set spanning tree priority for an MST Instance. Priority should be a multiplication of 4096. The switch with lowest priority value will become a root for defined MST Instance. It is important to set different switches as roots for different MST Instances. Please refer to chapter **Fehler! Verweisquelle konnte nicht gefunden**

		werden. "Root Bridge" definition for details.
8.	`show spanning-tree mst <0-30>`	Shows MST Instance information
9.	`show spanning-tree mst summary`	Shows MST summary
10.	`show spanning-tree mst port <slot/port>`	Shows an MST information of a port
11.	`show spanning-tree mst trunk <trunkname>`	Shows an MST information of a trunk
12.	`...`	Other commands are equal to RSTP configuration. Please refer to Table 4-8 for details.
13.	`exit`	Exits from MST configuration mode

Table 4-14. Commands to configure Multiple Spanning Tree

4.18 Q-in-Q and VLAN Translation

The IEEE 802.1ad specification, commonly named as Q-in-Q or provider bridging, extends the IEEE 802.1Q standard by providing of a second tier of VLANs in a bridged network. It is mainly used in Metro Ethernet networks to create several independent paths between end customers. They can use same VLAN numbers for own purposes and, unlike pure IEEE802.1Q, their traffic will not be mixed up in backbone network.

Q-in-Q technology uses a second VLAN tag in Ethernet packet to separate and split user traffic. It increases a number of VLANs in L2 network. The total number could be 4096 x 4096 = 116777216.

Q-in-Q interface could work in UNI (User-to-Network Interface) or NNI (Network-to-Network Interface. NNI interface is connected to core network and always works in Tagged mode. UNI interface is connected to customer network and can work in tagged or in untagged mode.

FXOS allows TPID change. TPID means Tag Protocol Identifier and has 0x8100 value to identify that packet has IEEE 802.1Q format. It is default TPID value for MiniFlex Switch for Q-in-Q outer TAG, but it could be changed manually. Commonly used TPID values are: 0x9100, 0x9200 or 0x9300. IEEE 802.1ad specifies 0x88a8 value for service-provider outer tag.

Q-in-Q implementations

There are two types of Q-in-Q implementations: Basic Q-in-Q and Selective Q-in-Q

- Basic Q-in-Q

  Basic Q-in-Q mode means that single defined TAG will be added when Ethernet packet will ingress to UNI port and egress from NNI port. The ingress packet could be tagged or untagged. If received packet has TAG already a second TAG will be added to it. If packet has no TAG, first of all it will be tagged with TAG of default VLAN and then second Q-in-Q TAG will be added.

- Selective Q-in-Q

  Selective Q-in-Q gives more flexibility to Basic Q-in-Q. In this mode it is possible to tag frames with different outer VLAN tags depending on TAG of ingress packet (inner TAG). FXOS will work in selective Q-in-Q mode when user will configure UNI interface in tagged mode. VLAN translation table could be created in this mode.

A list of Q-in-Q related commands is shown in Table 4-15.

#	Command	Description
1.	`qinq [enable|disable]`	Enables or disables a Q-in-Q feature for a switch
2.	`config qinq <portlist> [uni|nni]`	Set interface role as NNI or UNI for <portlist>
3.	`config qinq <portlist> [add|delete] <innervidrange> {<1-4094>}*1`	This command adds or deletes ports <portlist> with VLAN <innervidrange> to outer VLAN <1-4096>. The VLAN translation table has 1024 records. It means that maximum 1024 VLAN from <innervidrange> could be added
4.	`config qinq <portlist> tpid <hex_value>`	Set TPID value for outer Q-in-Q packet for selected <portlist>. You could configure up to 3 different TPID
5.	`clear qinq tpid <hex_value>`	You can clear the TPID through this command. If interface which has this TPID was added to a non-default VLAN, it will not clear the TPID.
6.	`show qinq vlan translation table`	Shows VLAN translation table
7.	`show qinq {<portlist>}*1`	Shows Q-in-Q information for <portlist>

Table 4-15. Commands to configure Q-in-Q

4.19 Jumbo Frames Support

MiniFlex Switch supports jumbo frames with up to 9216 bytes. A list of commands is shown in Table 4-16.

#	Command	Description
1.	`jumbo [enable|disable]`	Enables or disables Jumbo Frame support
2.	`show jumbo`	Show Jumbo Frame support status

Table 4-16. Commands to configure Jumbo frames

4.20 Radius

RADIUS (Remote Authentication Dial In User Service) is a universal authentication and accounting protocol. It provides authentication and authorization of equipment or users connected to the LAN. Through such authentication, point-to-point user authentication mode can be provided in such a multi-point access environment as LAN. The port here refers to a single-point structure connected to the LAN. It can be the MAC address of the authenticated system, a physical interface of a server or network equipment that is connected to the LAN, or a workstation and access point defined in the IEEE 802.11 wireless LAN environment.

The RADIUS protocol has Client – Server structure. Its original client is the NAS (Net Access Server), and clients are running on PC or other network devices that shall be authenticated.

When a user accesses the NAS, the NAS submits the user information to the RADIUS server in the Access-Require data packet, including information of user name and password. Among them, the user password is encrypted with MD5. Both parties use the shared key that is not transmitted on the network.

The RADIUS server and the NAS server communicate with each other via the UDP protocol. The 1812 port of RADIUS server is responsible for authentication, while the 1813 port for accounting. The UDP is adopted since in most cases the NAS server and the RADIUS server are located in the same LAN and the UDP is quicker and more convenient.

4.20.1 Configuring Radius Attributes

The MiniFlex Switch used as the Network Access Switch (NAS). It communicates with Radius servers through Radius packets. Attributes in these packets are used to transmit the detailed information of authentication, authorization and accounting. The attributes in the current NAS version refer to the standard ones specified in RFC2865, RFC2866 and RFC2869. The system currently supports the following RADIUS standard attributes:

Serial #	Attribute name	Attribute Description
1	User-Name	Authenticated user name
2	User-Password	PAP authentication password
3	CHAP-Password	CHAP authentication password
4	NAS-IP-Address	IP address of the NAS equipment initiating the authentication request
5	NAS-Port	Physical port of the NAS equipment used for user access
6	Service-type	Service type requested by the user
7	Framed-Protocol	Link layer protocol of user access
8	Framed-IP-Address	IP address distributed to the user in the Radius mode
18	Relay-Message	Text information displayed for the user
24	State	Radius server state
25	Class	Class attribute send by Radius server
27	Session-Timeout	By-duration prepayment support
28	Idle-Timeout	Maximum timeout time of user idle
31	Calling-Station-ID	MAC address of the broadband access user
32	NAS-Identifier	NAS equipment ID
40	Acct-Status-Type	Accounting status (start or end)
44	Acct-Session-ID	User accounting ID
45	Acct-Authentic	User authentication mode
46	Acct-Session-Time	By-duration accounting
47	Acct-Input-Packets	Total input packets of the account
48	Acct-Output-Packets	Total output packets of the account
49	Acct-Terminate-Cause	Accounting termination cause
60	CHAP-Challenge	CHAP authentication support

61	NAS-Port-Type	Port type of the NAS equipment
79	EAP-Message	EAP-MD5 authentication support
80	Message-Authenticator	EAP-MD5 authentication support
85	Acct-Interim-Interval	Real-time accounting support

4.20.2 Configuring Radius Authentication Service

MiniFlex Switch supports Radius Authentication Service. A list of commands is shown in Table 4-17.

#	Command	Description
1.	`radius authentication [enable|disable]`	Enables or disables Radius Authentication Service
2.	`radius authentication add-server id <0-4> server-ip <A.B.C.D> client-ip <A.B.C.D> {udp-port <1-6500>}*1`	Adds Radius authentication record. A Server ID is used for server selection. A Radius server with smallest ID will be selected firstly. It is possible to add up to 5 Radius servers. If server ID exists and you adding a new server with same ID you must delete an old one firstly. Client IP is an IP address of a Radius Client. UDP port will be used for radius messages. It is 1812 by default
3.	`radius authentication delete-server id <0-4>`	Deletes Radius authentication record for defined Radius server ID
4.	`radius authentication config-server id <0 - 4> shared-secret <secret>`	Configures a “shared secret” for defined Radius server
5.	`radius authentication config-server id <0-4> retransmit-interval <5-300>`	Sets retransmission interval for Radius server
6.	`radius authentication config-server id <0-4> max-retransmit-count <2-10>`	Sets maximal retransmission count for radius server
7.	`show radius`	Shows Radius setup

Table 4-17. Commands to configure Radius Authentication

4.20.3 Configure Radius Accounting Service

MiniFlex Switch supports Radius Accounting Service. A list of commands is shown in Table 4-18.

#	Command	Description
1.	`radius accounting [enable|disable]`	Enables or disables Radius Accounting Service
2.	`radius accounting add-server id <0-4> server-ip <A.B.C.D> client-ip <A.B.C.D> {udp-port <1-6500>}*1`	Adds Radius accounting record. A Server ID is used for server selection. A Radius server with smallest ID will be selected firstly. It is possible to add up to 5 Radius servers. If server ID exists and you adding a new server with same ID you must delete an old one firstly. Client IP is an IP

		address of a Radius Client. UDP port will be used for radius messages. It is 1812 by default
3.	`radius accounting delete-server id <0-4>`	Deletes Radius accounting record for defined Radius server ID
4.	`radius accounting config-server id <0 - 4> shared-secret <secret>`	Configures a “shared secret” for defined Radius server
5.	`radius accounting config-server id <0-4> retransmit-interval <5-300>`	Sets retransmission interval for Radius server
6.	`radius accounting config-server id <0-4> max-retransmit-count <2-10>`	Sets maximal retransmission count for radius server
7.	`show radius`	Shows Radius setup

Table 4-18. Commands to configure Radius Accounting

4.20.4 Configuring ISP-Domain

The ISP-Domain concept becomes popular in access networks. The idea of ISP-Domain is that user send authentication message with username @ domainname. The Network Access Server send user authentication to particular server, a domainname belongs to. Therefore users can choose several ISP to connect.

A list of isp-domain related commands is shown in Table 4-19.

#	Command	Description
1.	`create isp-domain <domain>`	Creates ISP-Domain <domain>
2.	`config isp-domain <domain> authentication [enable|disable]`	Enables or Disables authentication for ISP-Domain <domain>
3.	`config isp-domain <domain> authentication [add-server|delete-server] id <0-4>`	Add or delete Radius authentication server with ID <0-4> to ISP-Domain <domain>
4.	`config isp-domain <domain> accounting [enable|disable]`	Enables or Disables accounting for ISP-Domain <domain>
5.	`config isp-domain <domain> accounting [add-server|delete-server] id <0-4>`	Add or delete Radius accounting server with ID <0-4> to ISP-Domain <domain>
6.	`config isp-domain <domain> accounting interim-update-accounting interval <10-65535>`	Configures the interim update accounting interval in seconds
7.	`config isp-domain <domain> accounting interim-update-accounting disable`	Disable the interim update accounting interval
8.	`show isp-domain <domain>`	Shows information about ISP-Domain

Table 4-19. Commands to configure ISP-Domain

After the isp-domain is set up, and when a RADIUS server is added to the system, it can be used only after domain is allocated to it. By default, the system has a domain named “default”. If no domain is created, the system will send all user authentication requests to the RADIUS authentication server in this default domain. To delete a domain, RADIUS servers belonging to, you should delete Radius server from it firstly.

4.21 SNMP

The SNMP (Simple Network Management Protocol) is commonly used for configuration of network devices and for network status monitoring. FXOS currently supports SNMPc V1 and V2c. A list of SNMP related commands is shown in Table 4-20.

#	Command	Description
1.	`service snmp [enable|disable]`	Enables or disables the SNMP Service
2.	`config snmp community [readonly|readwrite] <string>`	Configures SNMP community string for read-only and for read and write access. Default community string for read-only access is “public”, for read and write access is “private”
3.	`service snmp trap [enable|disable]`	Enables or disables SNMP trap service
4.	`config snmp trapreceiver add <A.B.C.D> version [v1|v2c] {community <string>}*`	Configures a SNMP trap receiver. It is a SNMP manager with A.B.C.D IP address. You could optionally define TRAP community. If not defined the read-only community will be used for TRAP messages.
5.	`config snmp trapreceiver delete <A.B.C.D>`	Deletes SNMP trap receiver
6.	`config snmp trap type [all|interface|start] [on|off]`	Set SNMP traps “on” or “off”. You can define SNMP Trap behaviour for interface traps, for start up traps and for all traps
7.	`config snmpauthentrap [enable|disable]`	Enables or disables authentication trap message
8.	`service snmp rmon [enable|disable]`	Enables or disables the RMON service
9.	`show snmp community-string`	Shows SNMP current community strings
10.	`show snmp trap type`	Shows active SNMP traps that will be send by the system
11.	`show snmp trapreceiver`	Show SNMP Manager address
12.	`show debug snmp`	Show SNMP debug information

Table 4-20. Commands to configure SNMP

4.22 Access control

Access Control List (ACL) allows traffic filtering according to defined rules. It is possible to filter traffic in dependence of MAC address, IP address or TCP/UDP port numbers.

Access Control List has more then one rule. It should be attached to a port, or to a group of ports or trunk. Each rule in an ACL has own priority. Please note following statements while configuring an ACL:

- Creating a rule
  As an Access List consists of rules, a user need to create rule first

Each rule has own number in range of 1 – 1023 and could operate with source and destination MAC address, source and destination IP address, source and destination switch Port number, VLAN ID and TCP/UDP protocol number or protocol name.

- Creating a List
  Access Control List could have up to 63 rules . They have numbers from 1 to 63 and they can coexist. Therefore up to 63 rules could be added into access control list.

- Rule priority in a list
  FXOS starts to execute rules according to their positions in a list. The rule that exists on the top of the list will be executed as the latest; or other say, rules will be executed in the **reverse order** as they were added to the list. For example: configuration order: rule1, rule2, rule3; execution order: rule3, rule2, rule1

- Default role action
  Default role action is “deny”. It is possible to change it to “permit” state.

- Assigning an ACL to a port
  After you create at least one role and add it to at least one access list, you need to attach access list to a port. It is possible to attach up 63 ACL to a port. Each ACL has its own number and priority. Therefore several ACL could coexist on same port. They will be executed according to the sequence they were added and according to the priority.

- Execution of ACL based on priority value
  Priority is a value in range from 1 to 255. An ACL with higher priority will be executed as the latest. For example: ACL1 has priority 10, while ACL2 has priority 30. Therefore the execution section will be: ACL1, then ACL2.

- Executing of ACL with same priority
  If you add several ACL with same priority they will be executed in the **direct order**: first added, first executed. For example: configuration order: acl1, acl2, acl3; execution order: acl1, acl2, acl3.

- “Default” ACL
  As soon as you add one or more ACL to a port, a default ACL will be added to the same port too. It has “deny” rule to all packets. You could delete “default” ACL from a port if at least one user-defined ACL is assigned to it. You couldn’t assign single “Default” ACL to a port.

You could display an ACL configuration in port configuration mode or in ACL configuration mode with `access-list`

A list of ACL related commands is shown in Table 4-21.

#	Command	Description
1.	`acl`	Enters to Access Control List configuration mode
2.	`access-list {<1-63>}*1`	Displays ACL information about all or defined ACL
3.	`exit`	Exits from ACL configuration mode

4.	`rule <1-1023> [create|destroy]`	Creates or deletes access rule
5.	`rule {<1-1023>}*1`	Shows information about all access rules or about defined rule
6.	`rule <1-1023> add dip <A.B.C.D/M>` `rule <1-1023> add sip <A.B.C.D/M>`	Add Destination or Source IP to a rule with defined number. You could use /30 or /32 mask
7.	`rule <1-1023> add dmac <h.h.h>` `rule <1-1023> add smac <h.h.h>`	Add Destination or Source MAC address to a rule with defined number
8.	`rule <1-1023> add dport <portrange>` `rule <1-1023> add sport <portrange>`	Add Destination or Source Port to a rule with defined number
9.	`rule <1-1023> add protocol [tcp|udp|icmp|igmp|<0-254>]`	Add protocol based on its name or protocol number as defined in RFC1700
10.	`rule <1-1023> add vlan <1-4094>`	Add VLAN with defined VID number to a defined rule.
11.	`rule <1-1023> remove [sport|dport|vlan|smac|dmac|sip|dip|protocol]`	Remove item from a defined rule
12.	`access-list <1-63> [create|destroy]`	Creates or Deletes access list with given number
13.	`access-list <1-63> [add|remove] <rulelist>`	Add or remove rule or list of rules to defined access list. “rulelist” can be "1-4,6,8" for example, at most 16 rules are supported for each list
14.	`access-list <1-63> action <rulelist> [permit|deny]`	Defines an action “permit” or “deny” for defined access list. Default rule action is “deny”
15.	`access-list <1-63> priority <1-255>`	Set a priority for defined access list
16.	`access-list [enable|disable] <lists>`	Enable or disable defined ACL on a port. Lists can be "1-8,9,16" for example. 63 lists can be added to each port at most. **Note: you must enter port configuration mode to access this command.** Please refer to Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** for details.
17.	`access-list [enable|disable] default`	Configures default access list on current port, whose action is deny. **Note: you must enter port configuration mode to access this command.** Please refer to Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** for details.
18.	`install`	This command is available in ACL configuration mode and has the following meaning. As soon as you

		attach an ACL to a physical port it will keep its “disabled” state. ACL rules don’t work. To enable all ACL lists on all ports, type `install` command.
19.	`uninstall`	This command is available in ACL configuration mode. It switches all ACL to “disabled” state but don’t unbind them from physical ports.

Table 4-21. Commands to configure Access Control List

4.23 802.1x Access control

The IEEE 802.1x protocol nowadays commonly used in LAN environment that generally was developed as “multi-point to multi-point” media for simple and secure point-to-point authorization. It works on MAC level and provides Authentication and Authorization for a terminal device connected to a port of active network equipment, i.e. switch or wireless access point. The IEEE 802.1x protocol divides network elements into three parties.

The Supplicant

The supplicant is a client device (laptop, PC) that supports IEEE 802.1x protocol as a client. The supplicant is connected to **the Authenticator** over Ethernet or wireless link.

The Authenticator

The Authenticator is a network device, like switch or wireless access point, which acts as an aggregator of user traffic in a network. It is connected to an Authentication Server and acts as an intermediate agent between supplicants and network.

The Authentication Server

The Authentication Server is, for example RADIUS, server. It is responsible for security policy of the network. Upon receiving of authentication messages from **the Authenticator** it grants or block a network access for **the Supplicant**. The Authentication server could additionally manage bandwidth and QoS settings for a user.

The Supplicant is connected to the Authenticator via so called PAE (Port Access Entry). Until the Authentication Server will grant network access to a Supplicant, the PAE can accept only EAPOL (Extensible Authentication Protocol Over LAN) frames. These frames carry authentication and authorization messages. The other traffic is blocked until Authentication Server will unlock it.

Default 802.x settings are shown in Table 4-22.

#	Parameter	Default Value
1.	802.1x authentication service (enable/disable) on the Ethernet interface	Disable Modifiable configuration
2.	Control mode of the port (MAC-based/port-based)	MAC-based Modifiable configuration
3.	The authentication status of the port (Auto/forceauth/forceunauth)	Auto Modifiable configuration
4.	Verification method(chap/eap-md5/eap-tls/pap)	eap-md5 Modifiable configuration
5.	Keepalive (enable/disable)	Disable Modifiable configuration
6.	Authentication system send authentication request to a client(polling)	Disable Modifiable configuration

7.	Maximum no response count (keepalive max-no-response-count)	5 times Modifiable configuration
8.	Interval of sending keepalive packet(period)	300 seconds Modifiable configuration
9.	Maximum count allowed for the switch to retransmit data frames to the client (reAuthMax)	2 times Unmodifiable configuration
10.	Maximum count allowed to retransmit data frames to the network access device (max-req)	2 times Modifiable configuration
11.	Quiet period during which the authentication system will not accept any authentication request from the client system (quiet-period)	60 seconds Modifiable configuration
12.	Re-authentication mechanism (enable/disable)	Disable Modifiable configuration
13.	Interval of re-authentication (re-authentication period)	3600 seconds Modifiable configuration
14.	Timeout for the authentication system to receive data packets from the authentication server (server-timeout)	30 seconds Modifiable configuration
15.	Timeout for the authentication system to receive data packets from the client system(supp-timeout)	30 seconds Modifiable configuration
16.	Interval for the authentication system to re-transmit EAP-Request/Identity data frames to the client system (tx-period)	30 seconds Modifiable configuration
17.	Configuring the Session Timeout handling mechanism(reauthentication/logoff)	Logoff Modifiable configuration

Table 4-22. Default IEEE 802.1x Settings

4.23.1 Configuring Protocol parameters

A step-by step list to configure 802.1x protocol related commands is shown in Table 4-23.

#	Command	Description
1.	`config dot1x quiet-period <0-65535>`	Set the quiet period within which the authentication system will not accept any authentication request from the client system
2.	`config dot1x tx-period <1-65535>`	Configure the interval for the authentication system to re-transmit EAP (Extensible Authentication Protocol) - Request/Identity data frames to the client system
3.	`config dot1x max-req <1-10>`	Configure the maximum count of the authentication system to re-transmit the data frame to the client
4.	`config dot1x supp-timeout <1-65535>`	Configure the timeout for the authentication system to receive data packets from the client system
5.	`config dot1x server-timeout <1-65535>`	Configure the timeout for the

		authentication system to receive data packets from the authentication server
6.	`show dot1x`	Show 802.1x protocol parameter

Table 4-23. Commands to configure IEEE 802.1x protocol parameters

4.23.2 Configuring 802.1x Control for the port

A port has three authentication states: auto, force-authorized and force-unauthorized. A port is controlled in two modes: port-based control and MAC-based control.

In **the port-based control mode**, once a legal user has passed the authentication on one port, all the other users connecting to the port can obtain the access authority without being authenticated.

However, in **the MAC-based control mode**, all users at a port will be separately authenticated and charged. Only those users passing the authentication can obtain the authority to access the network. At different ports of the same authentication system, two different control modes can be configured. In the MAC-based control mode, one port can support multiple authentication users. PAP, CHAP, EAP-MD5 and EAP-TLS identity verification methods are available.

A list of steps to configure 802.1x control for a port is shown in Table 4-24.

#	Command	Description
1.	`config port [<portlist>|all] dot1x [enable|disable]`	Enable/disable the 802.1x authentication service
2.	`config port [<portlist>|all] dot1x authcontrolledportcontrol [auto|forceauth|forceunauth]`	Configure the authentication status of the port
3.	`config port [<portlist>|all] dot1x port-control-mode [mac-based| port-based]`	Configure the port control mode
4.	`config port [<portlist>|all] dot1x max-hosts <1-16>`	Configure the maximum number of the clients allowed to access the specified port (this command is only valid for the port based on the MAC control mode)
5.	`config dot1x authenticate-protocol [chap|eap-md5| pap |eap-tls|peap]`	Configure the authentication mode of the user
6.	`show port [<portlist>|all] dot1x`	Show 802.1x Control of the port
7.	`show dot1x authenticate-protocol`	Show the authentication methods of different users

Table 4-24. Commands to configure IEEE 802.1x control for a port

4.23.3 Setting the Re-authentication Mechanism

To ensure that the link between users and the authentication system (MiniFlex switch) is in active status, and the accuracy of user accounting will not be affected due to the abnormal program suspension resulting from the equipment failure at the user side, the authentication system can periodically initiate the re-authentication process.

A list of steps to configure re-authentication mechanism is shown in Table 4-25.

#	Command	Description
1.	`config port [<portlist>|all] dot1x [enable|disable]`	Enable/disable the 802.1x authentication service
2.	`config dot1x re-authentication [enable|disable]`	Enable/disable the re-authentication mechanism
3.	`config dot1x re-authentication period <1-65535>`	Configure the re-authentication interval
4.	`show dot1x`	Show 802.1x protocol parameter

Table 4-25. Commands to configure re-authentication mechanism

4.23.4 Configuring Keep-alive Mechanism

Besides the re-authentication mechanism, to check whether an access user is in the connected status, the access module provides another kind of detection mechanism, named the Keep-alive mechanism. For the re-authentication mechanism, it needs to initiate a complete authentication process for each online user. If the number of users is tremendous, authentication packets will be frequently generated as a result of enabling the re-authentication function, therefore increasing the load of the switch to a certain amount. However, for the Keep-alive mechanism, it only needs to exchange a few packets to identify whether a user is online. With the keep-alive method, the switch periodically sends detection request packets, which adopts the EAP (Extensible Authentication Protocol) Request/Identity packet defined in the 802.1x protocol, to the client. If the switch has received the EAP Request/Identity response from the client, it indicates that the user is online. Otherwise, the user has already gone offline.

A list of steps to configure Keep-alive mechanism is shown in Table 4-26.

#	Command	Description
1.	`config port [<portlist>|all] dot1x [enable|disable]`	Enable/disable the 802.1x authentication service
2.	`config dot1x keepalive [enable|disable]`	Enable/disable the Keep-alive function
3.	`config dot1x keepalive period <10-3600>`	Set the interval to send a detection packet
4.	`config dot1x keepalive max-no-response-count <2-30>`	Set the Max No Keep-alive Response Count
5.	`show dot1x`	Show 802.1x protocol parameter

Table 4-26. Commands to configure keep-alive mechanism

4.23.5 Forcing users to Log out from the Authentication Status

For the providing of management and security, the MiniFlex switch allows the administrator to force one or more users to log out from the authentication status according to the following conditions:

- Force the user to log out from the authentication status based on user name
- Force the user to log out from the authentication status based on client MAC address
- Force all users to log out from the authentication status

A list of commands to configure user status is shown in Table 4-27.

#	Command	Description
1.	`config dot1x pae force-logoff username <username>`	Force the user to log out from the authentication status based on username
2.	`show dot1x pae username <username>`	Show the PAE (Port Access Entry) state machine based on username
3.	`config dot1x pae force-logoff port <port>`	Force the user to log out from the authentication status based on the port number
4.	`show dot1x pae port <port>`	Show the PAE state machine based on the port
5.	`config dot1x pae force-logoff all`	Force all users to log out from the authentication status
6.	`show dot1x pae all`	Show the PAE information

Table 4-27. Commands to configure user-status

4.23.6 Configuring Session Timeout Mechanism

Session Timeout is an attribute transmitted by the Radius Server through the Access Accept packet. In RFC2866, it means the duration of the access service used by an authorized user. If the time is out, the Radius Server will terminate the access service and force the user to get offline. This attribute has been extended by the access module used in the MIniFlex switch so that it can be used according to the standard specified in RFC2866, and also explained as that the server intends to re-authenticate a user. The value of Session Timeout is the re-authentication interval:

```
config dot1x session-timeout-type [reauthentication|logoff]
```

4.24 Configuring DHCP Relay, DHCP Option 82 and DHCP Snooping

The Dynamic Host Configuration Protocol (DHCP) provides a framework for passing configuration information to hosts on a TCP/IP network. The DHCP relay on the MiniFlex Switch transfers DHCP packets from other VLAN and allows DHCP clients, which belong not to the same VLAN with DHCP server, to use DHCP protocol to get IP address. The DHCP relay also supports Option 82

DHCP Option 82 that named the "Relay Agent Information" provides a mechanism for generating IP addresses based on location the client device is in the network. Information about its location can be sent along with the request to the server. The DHCP server makes a decision what IP should be assigned based on this information.

The DHCP Option 82 and DHCP relay agent are defined in RFC 3046.

The DHCP Snooping technique is used for ensuring the security of DHCP-enabled networks. It is based on Layer 2 and prevents DHCP clients to receive IP address from non trusted DHCP servers, fake servers. It also prevents unauthorized IP change at user side.

4.24.1 DHCP Relay related commands

A list of commands to configure DHCP Relay is shown in Table 4-28.

#	Command	Description
1.	`config dhcpr [enable|disable]`	Enables or disables the DHCP relay
2.	`config dhcp serverip add <A.B.C.D>`	The MiniFlex switch should know an IP address of the DHCP server or servers it has to forward clients requests to. This command adds DHCP server with A.B.C.D IP address. It is possible to have up to 32 servers in a system, IP addresses shouldn't be duplicated. The server should be reachable from the MiniFlex Switch over IP protocol.
3.	`config dhcp serverip delete [<A.B.C.D>|all]`	Deletes a DHCP Server by its IP address from the DHCP relay table. User can deletes all DHCP servers from the relay table. If no DHCP server address exists in the table, the DHCP relay will send nothing. The DHCP relay table will be automatically cleared after disabling the dhcpr service.
4.	`show dhcp serverip`	Shows DHCP relay Server table
5.	`show dhcpr statistic`	Shows DHCP Relay statistics
6.	`show dhcpr status`	Shows the DHCP Relay status
7.	`config dhcpr hoplimit <1-16>`	Configures number of hops in packets have to be send to DHCP Server. Default hop limit is 4. When MiniFlex switch receives REQUEST DHCP packet it will add 1 to its "hop" value and sends it further to DHCP Server.
8.	`no dhcpr hoplimit`	Sets hop limit value to default: 4 hops.
9.	`config dhcpr option82 [enable|disable]`	Enables or disables Option 82 for DHCP relay service. DHCP Relay Option 82 should be used when DHCP Server and Clients belongs to different VLANs and can't exchange information directly.
10.	`config dhcp l2 option82 [enable|disable]`	Enables or disables Layer 2 Option 82 for DHCP. This mode is used when DHCP Server and Client share same VLAN. **Note: L2 Option 82 and DHCP Relay couldn't be enabled simultaneously.**
11.	`config dhcp l2 option82 type [circuit-id|remote-id|both]`	Configures Layer 2 DHCP option 82 for circuit-ID, remote-ID or circuit-ID & remote-ID. By default, it is circuit-ID& remote-ID.

12.	`config dhcp l2 option82 remote-id [mac|ip|hostname]`	Configures Layer 2 DHCP Option 82 remote-ID for switch MAC, switch IP or switch hostname. By default, it is switch MAC.
13.	`config dhcp l2 option82 [circuit-id|remote-id] <string>`	Gives you an option to freely specify Option 82 for circuit-id or remote-id with <text>
14.	`show dhcp l2 option82 statistic`	Shows Layer 2 DHCP Option 82 statistics
15.	`show dhcp l2 option82 status`	Displays Layer 2 DHCP Option 82 status

Table 4-28. Commands to configure DHCP Relay

4.24.2 DHCP Snooping related commands

When a user contact a DHCP server and asks for an IP address a normal DHCP sequence has to be analyzed by IGMP Snooping function of MiniFlex Switch. The new record will be created and traffic will pass from and to the User port. If user will change his IP address manually the traffic will be blocked by DHCP Snooping function. A Network Administrator has to create static entries in case if he allows User to create static IP address. He has to add it into DHCP Snooping binding table.

A list of commands to configure DHCP Snooping is shown in Table 4-29.

#	Command	Description
1.	`config dhcp-snooping [enable|disable]`	Enables or disables the DHCP Snooping feature
2.	`config dhcp-snooping add-ip <A.B.C.D> port <slot/port> vlan <vlanname>`	Adds the static record into DHCP Snooping table
3.	`config dhcp-snooping delete-ip <A.B.C.D> port <slot/port> vlan <vlanname>`	Deletes the static record from DHCP Snooping table
4.	`show dhcp-snooping`	Shows DHCP Snooping table

Table 4-29. Commands to configure DHCP Snooping

4.24.3 Secure Forwarding related commands

In the Ethernet Network several users share common media and could affect the data transmission and create malfunctions for a whole network willfully or unintentionally. For example user could create own DHCP server and break an originally designed IP plan. To protect a network from such malfunction a ***`config port <portlist> [customer | uplink]`*** command is used. A DHCP server connected to customer port will become not valid. All packets from it will be blocked by DHCP Snooping feature. Only the DHCP Server connected to the uplink port will become valid. Please note that you have to enable DHCP Snooping to activate protection against fake DHCP server.

Default port role is “Uplink” for GE ports and “Customer” for FE ports. To display port role type `show port type`

A Network Administrator could configure his network that way so the customers could connect only with the gateway, but not between each other. This feature named Secure Forwarding.

A list of Secure Forwarding related commands is shown in Table 4-30.

#	Command	Description
1.	`secureforward [enable|disable]`	Enables or disables the Secure Forwarding feature. When enabled, switch will look into DHCP packets and get information from them.
2.	`secureforward [manual|dynamic]`	Configures the way how the Secure Forwarding function will learn information about gateway. In dynamic mode it will be learned from DHCP packet "Default Gateway" field. In Manual mode you have to configure it yourself.
3.	`secureforward add router vlan <1-4094> ip <A.B.C.D> mac <H.H.H>`	Configures gateway in manual mode
4.	`secureforward customer port <portlist> [enable|disable]`	Configures secure forwarding feature between ports their role is set to "customer". If disabled, the customers can exchange information. If enabled, the customers can exchange information with "uplink" ports only.
5.	`secureforward delete router vlan <1-4094>`	Deletes gateway information
6.	`show secureforward [<1-4094>|all]`	Shows secure forwarding information
7.	`show secureforward customer port {<portlist>}*1`	Shows secure forwarding status for customers ports
8.	`show secureforward mode`	Shows secure forwarding operational mode

Table 4-30. Commands related to Secure Forwarding

4.25 Quality of Service (QoS)

Quality of Service (QoS) technique has to be used in case if different types of traffic share the common transmission media. For example, over single Ethernet interface, user sends high priority traffic, i.e. VoIP and surfs WEB. System shall grants as less as possible delivery delay for VoIP packets, while HTTP traffic could be transmitted slowly. Another aim of correct QoS handling is to grant delivery and bandwidth to business critical applications and left the best effort to bulk traffic.

4.25.1 Queues

The MiniFlex switch is able to prioritize user traffic and sort it into several queues. Each queue will belong to own Class of Service and will be treated according to its priority. 8 queues are supported for each Fast Ethernet and Gigabit Ethernet port in egress direction. Current FXOS version supports Strict Priority (SP), Weighted Round Robin (WRR) and SP + WRR queue scheduling management per port.

- Strict Priority

  The Strict Priority scheduling mechanism means that each queue associated with the egress port is serviced according to the priority order from highest 7 to lowest 0. All traffic for a given queue is transmitted before the scheduler proceeds to the next highest priority queue. The purpose of strict priority scheduling is to ensure lower latency and priority transmission of critical traffic by always transmitting higher priority traffic before lower priority traffic. The Strict Priority scheduling mechanism in the MiniFlex switch is not preemptive. Once a packet from a given queue is selected for transmission, the scheduler completes the sending of that packet before determining the next queue to service.

- Weighted Round Robin

  Weighted Round Robin (WRR) scheduling mechanism services each queue in round robin order from highest priority to lowest priority. WRR mechanism provides a weighted access to the egress port bandwidth at the packet level. A configurable weight from 1 to 15 could be assigned to each queue. This value represents the number of packets that will sent back to back from a given queue when the queue is serviced assuming there are sufficient packets in the queue. If there are less packets in the queue than the weight assigned to the queue, the scheduler sends all packets in the queue and then begins servicing the next queue.

  The WRR mechanism provides sharing of the egress port bandwidth across multiple queues. However, the ability to share the bandwidth is limited because the packet length is not fixed and it is not considered when scheduling mechanism sends packets from a queue. Therefore, assuming equal weights, a queue in which the average packet size is larger will get a larger share of the link bandwidth.

  In case if we consider that all Ethernet packets have same size the bandwidth allocation for each queue could be calculated as:

  queue_bandwidth = given_queue_weight / sum_of_all_queues_weight * total_bandwidth

- Strict Priority + Weighted Round Robin

  The MiniFlex Switch supports a scheduling mechanism that mixes strict priority scheduling and weighted round robin scheduling. This allows some of the queues on an egress port to be scheduled according to a strict priority algorithm and other queues on the same egress port to be scheduled according to the WRR scheduling algorithm. This flexibility allows a network administrator to select some queues to be scheduled with Strict Priority, i.e. with smallest possible delay, and to share the rest of the bandwidth between other queues, that are not so critical to delays. To achieve such mechanism, the system administrator needs to select WRR mechanism for scheduling and assign “0” weight to queues he wants to have Strict Priority.

4.25.2 Traffic to queues allocation mechanism

The MiniFlex switch could map user traffic into internal CoS queues by IEEE 802.1p priority field or by DSCP field in IPv4 packet. The DSCP to CoS mapping is disabled by default. The 802.1p priority is mapped “one to one” to CoS queues of MiniFlex switch. The queue 7 and 802.1p priority “7” have the highest scheduling priority while queue 0 and 802.1p priority “0” have the lowest scheduling priority:

```
-----802.1p Priority-----------Queue --------
             0              0
             1              1
             2              2
             3              3
             4              4
             5              5
             6              6
             7              7
-----------------------------------------
```

When enabled, the default DSCP mapping will assign all 64 DSCP code pointers to CoS queue “0” of MiniFlex Switch.

4.25.3 Configuring QoS

The list of commands related to QoS configuration is represented in Table 4-31.

#	Command	Description
1.	`qos default-priority <0-7>`	This command sets default CoS priority for a port. The ingress untagged packet without IEEE 802.1p tag will have defined QoS value in the header. When added to VLAN, the packet will be processed according to the TOS value in the VLAN header. The command is available under Ethernet port configuration mode. The packet has no QoS settings by default.
2.	`show default-priority`	Shows default CoS priority for a port. The command is available under Ethernet port configuration mode.
3.	`qos map priority-queue <0-7> to <0-7>`	Sets the mapping between IEEE 802.1p value and CoS queue of the MiniFlex switch. The command is available under Ethernet port configuration mode.
4.	`no qos map priority`	Sets QoS mapping to default values “one to one”. The command is available under Ethernet port configuration mode.
5.	`qos map dscp [enable|disable]`	Enables or disables DSCP to CoS mapping for a port. It is disabled by default. The command is available under Ethernet port configuration mode.
6.	`qos map dscp-priority <0-63> to <0-7>`	Sets the mapping between IPv4 DSCP field and CoS queue of the MiniFlex Switch. The command is available under Ethernet port configuration mode.
7.	`no qos map dscp`	Sets DSCP to CoS mapping to default values. The command is available under Ethernet port configuration mode.
8.	`show qos map [priority|dscp]`	Shows CoS mapping table for 802.1p or for DSCP. The command is available

		under Ethernet port configuration mode.
9.	`qos bandwidth <0-7> [<64-1024000>|0]`	Sets the bandwidth limitation for each queue <0 - 7> in kbps. The value must be a factor of 64 and must not be greater then the port capabilities. Value “0” means that bandwidth will not be limited. The command is available under Ethernet port configuration mode.
10.	`show qos bandwidth`	Shows bandwidth settings for each CoS queue. The command is available under Ethernet port configuration mode.
11.	`qos sched-mode [pq|wrr]`	Sets the scheduling mechanism: Priority Queue (PQ) is the Strict Priority while WRR is Weighted Round Robin. Default scheduling mechanism is PQ. The command is available under Ethernet port configuration mode.
12.	`qos queue-weight <0-15> <0-15> <0-15> <0-15> <0-15> <0-15> <0-15> <0-15>`	Sets a weight for every queue. The command has a meaning only if QoS scheduling mechanism is set to WRR. If queue weight is set to “0”, the Strict Priority scheduling mechanism will be used. The command is available under Ethernet port configuration mode.

Table 4-31. Commands related to QoS configuration

4.26 Configuring GVRP

The GVRP (GARP (Generic Attribute Registration Protocol) VLAN Registration Protocol) is useful for automatic VLAN configuration in Layer 2 network. To get the benefit of GVRP protocol it must be enabled on all switches in the network and NIC (Network Interface Cards) of terminal stations must support it as well.

The GVRP Protocol uses GVRP BPDU (GVRP Bridge Protocol data Units) for sharing information about enabled VLANs in the network. If a GVRP-enabled switch will receive GVRP BPDU it will automatically build VLAN configuration. The switch will forward GVRP BPDU further through other GVRP-enabled ports except the one, which receives initial GVRP BPDU. Therefore the whole network will be automatically configured from initial request of GVRP-enabled host.

A list of GVRP related commands is shown in Table 4-32.

#	Command	Description
1.	`config gvrp [enable|disable]`	Enables or disables the GVRP function on the MiniFlex switch
2.	`show gvrp`	Shows the GVRP status
3.	`config gvrp port [<portlist>|all] [enable|disable]`	Enables or disables the GVRP function for a port or group of ports. If GVRP function is enabled on a port it will participate in GVRP BPDU exchange mechanism.
4.	`config gvrp port [<portlist>|all]`	This command selects the port registration mode. GVRP have two port registration

	`registration [normal|forbidden]`	modes: Normal and Forbidden. In normal mode a port can dynamically register/deregister a VLAN and distribute the VLAN information. In forbidden mode a port can't register/deregister VLANs. It distribute only VLAN VID1 information
5.	`config gvrp timer [join|leave|leaveall] <1-100000>`	This command configures the GVRP join and leave timers in milliseconds.

Table 4-32. Commands related to GVRP

4.27 Anti DoS protection

The MiniFlex switch supports several Deny of Service (DOS) prevention mechanisms. To enable Anti-DoS protection type ***anti-dos-attack enable*** command. When enabled, the following cases will be blocked:

- Source IP and Destination IP are equal
  In case if IP packet has same Source and Destination IP, it will be blocked by the switch. The rule is valid for UDP or TCP packets.

- ICMP packet oversize
  If ICMP packet has greater size than defined (excluded Header), it will be blocked. You could define a ICMP packet maximum size in bytes with ***config icmppktoversize <0-16383>*** command.

- Equal port number
  If packet has same source and destination port number, such packet will be blocked. The rule is valid for TCP and for UDP packets

- TCP flags conditions
  In case if SYN and FIN flag is set to 1, or FIN, URG and PSH are set to 1 and packet sequence number is set to 0, or if Fragment offset is set to 1, or when all flags are set to 0 and sequence number is set to 0, the packet will be blocked.

The network administrator could limit the broadcast and multicast rate for defined port manually. Please refer to record 42 in Table 4-5 for details.

5 PROGRAMMING GUIDE LINE CARDS & DINRAIL

5.1 Command Structure SHDSL & Serial

Main Menu

PM Performance management	**FMM** Fault and maintenance management	**CM** Configuration management
G826	NM	SECURE [ON/OFF]
G826 C	LINKNM	USERS
ALLG826 N	STATUS	USER [name]
RESETG826	STATUS T	USER [name] DEL
RESETALLG826 N	STATUS L	USER [name] [+|-] [PRIV]
NETSTAT [LAN/WAN]	STATUS ETH	USER [name] [IP] [subnet]
NETERR [LAN/WAN]	STATUS EXT	USER [name] [LOCAL/ALL]
RESETNETSTAT	STATUS RADIUS	PASSWORD {user}
LINKSTAT	LOOP2 [N:[A/R]] [ON/OFF]	AUTO [ON/OFF]
LINKALARM	ALARM	CONFIG
ALARMLOG [N]	ALARM T	CONFIG [N/R/S/B]
ALARMLOG C	ACO	MASTER [ON/OFF] [N]
APPLY [ALL/GROUP]	ACO [GROUP] [ON/OFF]	EXT [ON/OFF] [N]
CONNECT [N:[1-13/R]]	MACTABLE C	BASERATE [N/AUTO] [M]
LINK [NN]	MACTABLE [1-8/OTHER/Port]	PAM [16/32] [N]
LINKCLEAR	MACTABLE	PAYLOAD [list] [N]
M(AIN)	STARTAL [N]	ANNEX [A,B,A/B] [N]
H(ELP)	RESTART [N]	SETCLOCK [list] [N]
	RESET	MULTIPAIR [2/OFF]
	CONFIRM	RESERVE [list]
	BACKUP	ID string
	RESTORE	RESPONSE [NN/OFF]
	DIFF [N/R/S/B] [N/R/S/B]	DEFAULT [0-4]
	DUMP [N/R/S/B]	DEFAULT EVERYTHING
	LOAD	DEFAULT DESC
	TLM	SERNUM
	TLM D	GSCOMPAT [ON/OFF]
	TLM S [N:Rnn-Rkk] [ABC]	NMTHR [N/OFF]
	TLM C	LATHR [N/OFF]
	LOG	PTMP [ADD/DEL] [IF]
	LOG C	PTMP SHOW
	SOFTUPDATE	MODE [N]
	TFTP [CMD] [ARG1][ARG2]	RSIP [I/O] [addr] [IF]
	SOFTCONFIRM	RSIP {option} [IF]
	SOFTINFO	LICENSE
	PING x.x.x.x	LICENSE ADD [key]
	LINKSTAT	RSRATE [N]
	RSTP [CONF/STATE]	RSFORMAT [Format]
	MODEMVIEW	RSDUPLEX [F/H]
	SD SNAPSHOT	RS [232/485]
	SD DIR	RS TERM [ON/OFF]
	SD DEL [NAME]	APPLY [ALL/GROUP]
	SD SAVE [N=0..9]	CONNECT [N:[1-13/R]]
	SD LOAD [N=0..9]	LINK [NN]
	SD BOOT [ON/OFF]	LINKCLEAR
	SD STATUS	NET ⟶
	APPLY [ALL/GROUP]	M(AIN)
	CONNECT [N:[1-13/R]]	H(ELP)
	LINK [NN]	
	LINKCLEAR	
	M(AIN)	
	H(ELP)	

NET ⟶

NETCONFIG
NETCONFIG [N/R/S/B]
COSCONFIG
COSCONFIG [N/R/S/B]
RSTP DEFAULT
RSTP [CONF/STATE]
RSTP [BR/IF] [OPT] [N]
RSTP [A..E] [ON/OFF]
PBVLAN [IF] [A..E]
MODE [IF] [ACC/TRUNK/MIX]
VLAN [IF] [1..8]
QOS [IF] [0..7]
ALLOW [IF] [VLAN list]
VID [1-8] ID
MACLIST SHOW
MACLIST SHOW [N/R/S/B]
MACLIST [IF] ADD [MAC]
MACLIST [IF] DEL [MAC/N]
MACFILTER [LAN1-5] [ON/OFF]
MACRULE [LAN1-5] [rule]

SETIP x.x.x.x
GATEWAY x.x.x.x
NETMASK x.x.x.x
MTU [68..1500]
WANIDLE [1/7E]
ETHSD [MODE] [N=1-2]
FC [ON/OFF] [N=1-2]
IRATE [speed/OFF] [N=1-2]
ERATE [speed/OFF]
CRATE [speed] [CoS] [WAN]
COS [QOS/VLAN] [N] [0..3/OFF]
SNMP [V1|V2C|V3] [ON|OFF]
SNMPACL [1/2] [IP/OFF]
TRAPIP [1/2] [IP/OFF]
TRAP [1/2] [V1/V2C]
TRAP [1/2] V3 [RO/RW]
COMMUNITY
COMMUNITY [GET/SET/TRAP]
SNMPSET [ON/OFF]
SNMP [RO|RW] NAME
SNMP [RO|RW] AUTH [MODE]
SNMP [RO|RW] PRIV [MODE]
RMONALARM N [ON/OFF]
RMONEVENT N [ON/OFF]
SNTP [1/2] [IP/OFF]
SNTP TZ [+/-]HH:MM
DST [SUMMER|WINTER]
DST [OFF/INFO/NAME]
SYSLOG [1/2] [IP/OFF]
[SSH|TELNET|HTTP] [ON/OFF]
SSH PORT [N]
RADIUS [1/2] [IP:P/OFF]
RADIUS [1/2] SECRET
RADIUS RETRIES [0..10]
RADIUS TIMEOUT [1..5]
RADIUS [1/2] TEST
STATUS RADIUS [N/R/S/B]
NETDEFAULT
APPLY [ALL/GROUP]
CONNECT [N:[1-13/R]]
LINK [NN]
LINKCLEAR
M(AIN)
H(ELP)

Table 5.1 Command structure according to ITU-T Rec. M.3400 (Telecommunication Management Networks)

5.2 Command Structure FOM, POE & Switch

Main Menu		
PM Performance management	**FMM** Fault and maintenance management	**CM** Configuration management
NETSTAT	STATUS	SECURE [ON/OFF]
NETERR	STATUS POE	USERS
RESETNETSTAT	STATUS SFP	USER [name]
ALARMLOG	STATUS RADIUS	USER [name] DEL
ALARMLOG C	ALARM	USER [name] [+|-] [PRIV]
APPLY [ALL/GROUP]	ALARM T	USER [name] [IP] [subnet]
M(AIN)	ACO	USER [name] [LOCAL/ALL]
H(ELP)	ACO [GROUP] [ON/OFF]	PASSWORD {user}
	MACTABLE C	ID string
	MACTABLE [1-8/OTHER/Port]	SERNUM
	MACTABLE	NETCONFIG
	RESET	NETCONFIG [N/R/S/B]
	RESET POE	COSCONFIG
	CONFIRM	COSCONFIG [N/R/S/B]
	BACKUP	RSTP DEFAULT
	RESTORE	RSTP [CONF/STATE]
	DIFF [N/R/S/B] [N/R/S/B]	RSTP [BR/IF] [OPT]
	DUMP [N/R/S/B]	RSTP [A..E] [ON/OFF]
	LOAD	PBVLAN [IF] [A..E/S]
	LOG	MODE [IF] [ACC/TRUNK/MIX]

LOG C	VLAN [IF] [1..8]
SOFTUPDATE	QOS [IF] [0..7]
TFTP [CMD] [ARG1][ARG2]	ALLOW [IF] [VLAN list]
SOFTCONFIRM	VID [1-8] ID
SOFTINFO	MACLIST SHOW
PING x.x.x.x	MACLIST SHOW [N/R/S/B]
RSTP [CONF/STATE]	MACLIST [IF] ADD [MAC]
MODEMVIEW	MACLIST [IF] DEL [MAC/N]
APPLY [ALL/GROUP]	MACFILTER [LAN1-5] [ON/OFF]
M(AIN)	MACRULE [LAN1-5] [rule]
H(ELP)	SETIP x.x.x.x
	GATEWAY x.x.x.x
	NETMASK x.x.x.x
	MTU [68..1500]
	ETHSD [MODE] [N=1-5]
	FC [ON/OFF] [N=1-5]
	IRATE [speed/OFF] [N=1-5]
	ERATE [speed/OFF]
	COS [QOS/VLAN] [N] [0..3/OFF]
	SNMPACL [1/2] [IP/OFF]
	TRAPIP [1/2] [IP/OFF]
	COMMUNITY
	COMMUNITY [GET/SET/TRAP]
	SNMPSET [ON/OFF]
	RMONALARM N [ON/OFF]
	RMONEVENT N [ON/OFF]
	SNTP [1/2] [IP/OFF]
	SNTP TZ [+/-]HH:MM
	SYSLOG [1/2] [IP/OFF]
	[SSH|TELNET|HTTP] [ON/OFF]
	SSH PORT [N]
	RADIUS [1/2] [IP:P/OFF]
	RADIUS [1/2] SECRET
	RADIUS RETRIES [0..10]
	RADIUS TIMEOUT [1..5]
	RADIUS [1/2] TEST
	NETDEFAULT
	DEFAULT 0
	DEFAULT EVERYTHING
	DEFAULT DESC
	LICENSE
	LICENSE ADD [key]
	POECONFIG
	POEPORT [ON/OFF] [N]
	APPLY [ALL/GROUP]
	M(AIN)
	H(ELP)

Table 5.2 Command structure according to ITU-T Rec. M.3400 (Telecommunication Management Networks)

5.3 SHDSL, Serial, FOM, POE & Switch Line Card & DINrail Software

Every SHDSL & FOM line card & DINrail stores up to two software versions in the memory (EEPROM): one unchangeable software (standby software No.1) and one upgradeable software (software No.2). Two versions are necessary to prevent any device failure due to downloading of faulty or damaged software or due to hardware failure during downloading of the new software.
During downloading, the new software overwrites the upgradeable software. If the new software downloading via X-modem is successful, a message appears that the modem should be restarted to start operating under the new software. After the restart, i.e., when the new version of the upgraded software is started for the first time, the operator should confirm the downloaded software. After confirmation, this software becomes unchangeable. If downloading was interrupted or there was a failure in the data transmission, a message is displayed. In this case, if the data has already been partially downloaded into the modem and the upgradeable software is damaged, the unchangeable software will be used to start the modem (please repeat the downloading of the software).

By default, the upgradeable software is the basic one, if it was confirmed. If the upgradeable software was not confirmed after the first start or it was damaged (invalid data format, incorrect checksum), the standby software is loaded.

5.4 Configuration and Application Storage

The whole the system stores four configurations: running configuration, startup configuration, new configuration and backup configuration.
The **running configuration** contains all configuration values guarantee the current operation of the device. If two modems have the same version of the software and the same running configuration they should operate equally. The running configuration is stored in the RAM of the device. The current parameters determine the operation until the next restart or any actions on the running configuration (storage and etc.). During initialization the initial parameters of the running configuration are loaded from the startup configuration.
The **startup configuration** contains all configuration values which will be used to configure the device after its restart. The startup configuration is stored in EEPROM and is used to initialize the running configuration during the system start-up.
The **new configuration** stores changes in configuration parameters combined into groups of parameters that require a confirmation of changes (i.e., this configuration stores setting, which should be confirmed after being changed, for example, IP-address of the device). The new configuration is stored in the device RAM. After setting all necessary changes from the group, the system administrator confirms changes in the group, and values belonging to this group are written from the new configuration into the running one. In this case, the simultaneous application of all setting in the group is guaranteed.
The **backup configuration** is a backup of the current configuration. The backup configuration is stored in the EEPROM. During the configuration restoration, values from the backup configuration are copied to the startup configuration.

All configuration parameters are divided into three groups according to their application:

- configuration parameters applied after the restart
- configuration parameters applied instantly
- configuration parameters requiring a confirmation

Configuration changes, which are used after the restart, are written into the startup configuration, but before doing the restart the device continues working according to its “old” configuration. During the device restart, the values of these configurations are copied from the startup configuration into the running one and thus become valid.

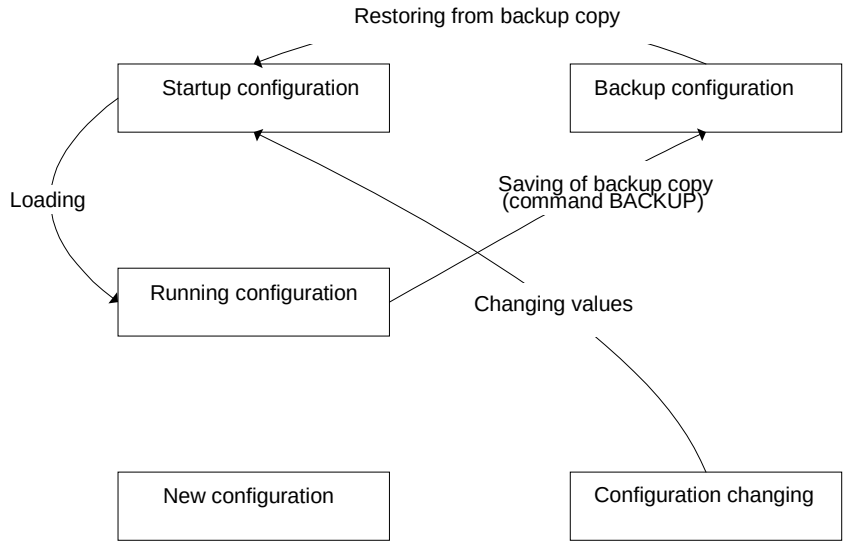


Figure 5.1 Operations of the configuration parameters after the restart

Configuration changes, which are used instantly, are written into the running, startup and new configuration, and the device continues working according to these configurations.

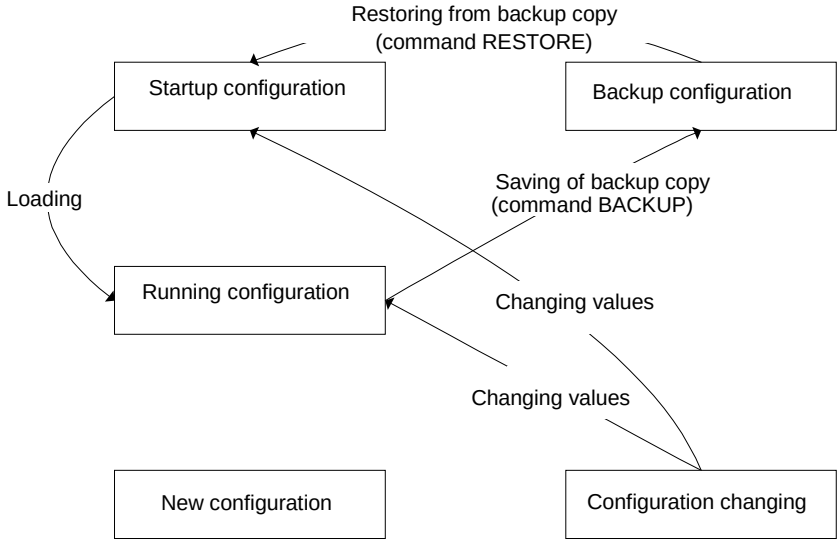


Figure 5.2 Operations of the configuration parameters with the instant application

Changes in configurations, which are part of a group of configurations that require a confirmation, are initially written into the new configuration. After the administrator confirms changes in the group of configurations, this group is copied from the new configuration into the running configuration and the device starts working according to these configurations. The administrator also can confirm changes in all groups. After the received running configuration is checked, the administrator can confirm this configuration. In this case, changes in all groups are copied from the running configuration into the startup configuration.

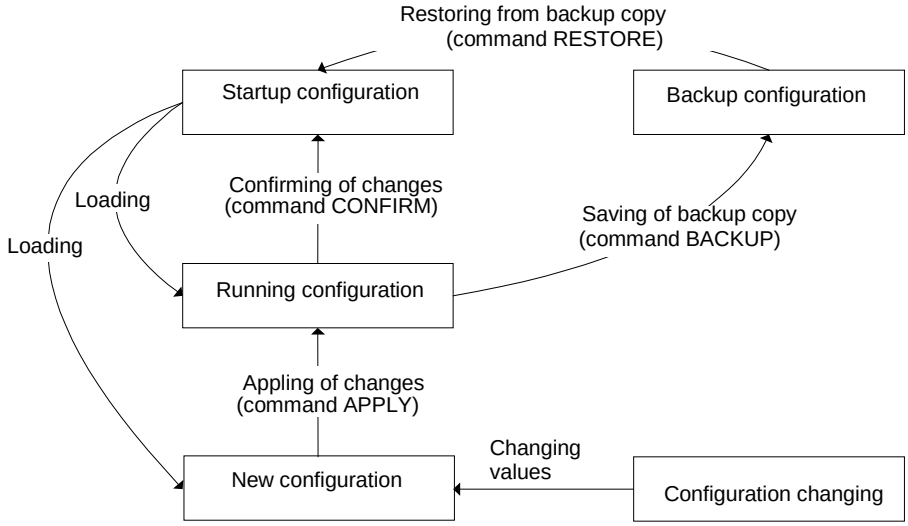


Figure 5.3 Operations of configuration parameters that should be confirmed

5.5 Groups of Commands Requiring Confirmation

In the SHDSL line card & DINrail the following four groups of parameters require a confirmation: LINE, NET, VLAN and SNMP. Changing configurations of each group use some special commands. The APPLY <name of the group> command is used to apply changes in configurations performed in a group. After this, the unit applies changes in configurations. If

groups LINE, NET, VLAN were changed not in the local management session via the USB interface but via Telnet the management session breaks and the unit waits for the second connection within 5 minutes (for the LINE group – 30 minutes). If the LINE group was changed remotely (using the CONNECT command), the unit waits for the second connection within 30 minutes. If within this time the operator did not enter the modem menu, the changed parameters are read from the startup configuration of the unit. Therefore, it is possible to restore the configurations of the unit. A “successful” configuration can become the startup configuration by using the CONFIRM command.

5.6 Command Syntax

The following rules are used to describe commands:

- parameters in angular brackets **< >** are obligatory
- parameters in direct brackets **[ ]** are not obligatory
- the symbol (***/***) between parameters requires to enter one of the listed parameters
- in real commands brackets and vertical line are not entered, they are used for description
- after the command is typed, press **<enter>**

5.7 Commands

5.7.1 Main Menu

The main menu is presented as shown below:

```
MODEL MF-PAM-RAIL2N-2Eth, V1
HW 5.2
SW 1.4.37 EXT rates
DATE 29-11-2012
ID
RUNS 0d 00:27:05
ALARM URGENT
STATUS LINK DOWN
MODEL_DESC MiniFlex Double xDSL/Double Ethernet 120 Ohm
IP 192.168.0.235



------------- Main Menu -----------------
1. Performance management (PM)
2. Fault and maintenance management (FMM)
3. Configuration management (CM)

5. Exit
-----------------------------------------
Select [1..5]
CP_MM>
```

To select the desired sub-menu, type the appropriate number from “1” to “5” and press <enter>.

5.7.1.1 System Invitation

The following format of the system invitation is used in all menus:

<**cc**>_<**addr**>_<**sf**>>

cc is the device mode:

- RR - Regenerator
- CO – Master
- CP – Slave
- CX – Modem with both types of modes (MASTER and SLAVE)
- CA – Device with automatic selection of the DSL line parameters (MASTER, BASERATE, PAM and ANNEX)

addr is the address of:

- Regenerator in the system (only for Regenerators)
- LTU device in the subrack (slot number, only for subrack LTU devices)

sf is the short form of the current menu:

- MM – Main Menu
- PM – Performance Management
- FMM – Fault and Maintenance Management
- CM – Configuration Management).

For example: CO_PM>
means the device is in the Master mode and we are in the Performance Management menu.

5.7.2 General Commands

5.7.2.1 <H> Command

After the <H> command is entered the device displays the help menu.

5.7.2.2 <APPLY [ALL/GROUP]> Command

This command is used to apply changes in all groups or to apply changes in one of these groups: LINE, VLAN, NET, and SNMP. As a result, changed in the group are written from the new configuration into the running one. Examples:

```
CO_FMM>APPLY
Applying all configuration changes to running configuration

CO_PM>APPLY LINE
Applying configuration changes in group LINE to running configuration
```

5.7.2.3 <CONNECT N:1..13/R> Command

The <CONNECT N:1..13/R> commands initialize the management of the remote device. The parameter N sets the number of the SHDSL channel, over which the connection is initialized. In single-channel systems the parameter N can be absent.

Notes:
1. The <CONNECT R> command in the Slave mode is only available if the Master device can be configured locally at this instant.
2. The <CONNECT N> (N=1..13) command initializes the management of the remote regenerator. The <CONNECT N> command is only available in the Master mode.
3. This command is not provisioned for regenerators.
4. If the channel of remote management is blocked (for example, a message or a table are not displayed completely), press Enter.

5.7.2.4 <LINK [SN/00/FE]> Command

The < LINK [SN/00/FE]> command establishes connection to specified unit over the backplane.

- SN - Specifies the slot number of a subrack unit to connect with. If the backplane is busy or if the specified subrack slot is free (or no response in 1.5 first seconds) the "LINK ERROR" message will be issued by the unit. For subrack units SN should not be 00.
- 00 - (double zero) Switches on the Monitor (Local Craft Terminal) connector control mode for Minirack and standalone units. In this mode all typed characters will be translated to the Monitor connector.
- FE - (for ever) Switches on Monitor connector control mode for common CLI RS232 units. In this mode all typed characters will be translated to Monitor connector. The connection will be established until a terminal timeout appears.

Example:
- LINK 10 - Establish connection to subrack unit with slot number 10.
- LINK 00 - Establish monitor control node.
- LINK FE - Establish monitor control node.

Notes: To refuse link connection just exit from controllable unit.
To refuse link connection urgently use CTRL+Z keystroke.

5.7.2.5 <LINKCLEAR> Command

The < LINKCLEAR > command closes current virtual link connections.

5.7.3 Performance Management Menu

After typing “1” in the main menu and pressing <enter>, the following message is displayed:

```
Performance management activated
Enter 'M' to return to MAIN, or 'H' for HELP information

CO_PM>
```

5.7.3.1 <H> Command

Type <H> and the monitor list all available commands in the performance sub-menu. If you type H [command] you will get additional help on [command].

```
CO_PM>H
------------------------------------------------------------------------------
Type 'H [command]' to get additional help on [command]
G826                    Display xDSL G.826 statistics
G826 C                  Display xDSL G.826 statistics continuously
ALLG826 N               Display xDSL G.826 statistics for all link
RESETG826               Reset G.826 statistics
RESETALLG826 N          Reset xDSL G.826 statistics for the whole link
NETSTAT [LAN/WAN]       Show network statistics counters
NETERR [LAN/WAN]        Show network error counters
RESETNETSTAT            Reset network counters
LINKSTAT                Display link status of all xDSL channels
LINKALARM               Display link alarms of all xDSL channels
ALARMLOG [N]            Display the link alarm log
ALARMLOG C              Clear the link alarm log
LINKNM                  Trace xDSL noise margin of all accessible units
LINKDIAG                Trace xDSL status of all accessible units
APPLY [ALL/GROUP]       Apply changes to running configuration
CONNECT [N:[1-13/R]]    Establish connection to remote unit
LINK [NN]               Establish local connection
LINKCLEAR               Exit all local connections
M                       Return to Main Menu
H                       Show available commands
------------------------------------------------------------------------------
CO_PM>
```

5.7.3.2 <G826> Command

This command displays the ITU-T G.826 performance parameters of the two SHDSL lines.

```
CO_PM>G826
------------------------------------------------------------------------------

G.826 Error Performance  :   CRC6 1     CRC6 2
------------------------------------------------------------------------------

Errored blocks           : 0000000000 0000000000
Errored seconds          : 0000000000 0000000000
Severely errored seconds : 0000000000 0000000000
Background block errors  : 0000000000 0000000000
ESR  [%]                 :       0.00       0.00
SESR [%]                 :       0.00       0.00
BBER [%]                 :       0.00       0.00
Available time           : 0000000000 0000000000
Unavailable time         : 0000023365 0000023365
------------------------------------------------------------------------------

CO_PM>
```

Option: C – update the table continuously.

CRC6 – Cyclic redundancy check indicating errored blocks received on the SHDSL side.
Errored Block (EB) – A block (transmission duration 6ms) in which one or more bits have errors.
Errored Seconds (ES) – A second period with one or more errored blocks or at least one defect.
Severely Errored Seconds (SES) – A one-second period, which contains more than 30% of errored blocks per second from the total number of all received blocks. SES is a subset of ES.

Background Block Error (BBE) – An errored block not occurring as a part of SES.
Errored Second Ratio (ESR) – The ratio of ES to total seconds in available time during a fixed measurement interval.
Severely Errored Seconds Ratio (SESR) – The ratio of SES to the total number of error-free seconds in available time during a fixed measurement interval.
Background Block Error ratio (BBER) – The ratio of BBE to the total number of error-free seconds in available time during a fixed measurement interval.
Available time – The period when measurements of the parameters are possible.
Unavailable time – The period when the measurements of the parameters are impossible.

5.7.3.3 <ALLG826 N> Command

This command displays the ITU-T G.826 performance parameters of the specified SHDSL line for the local and remote devices as well as for Regenerators.

```
CO_PM>ALLG826 1
--------------------------------------------------------------------------------
G.826 Error Performance  :  MASTER     N <-- RR1 --> C     SLAVE
--------------------------------------------------------------------------------
Errored blocks           : 000000006 000000001 000000014 000000001
Errored seconds          : 000000002 000000001 000000014 000000001
Severely errored seconds : 000000000 000000000 000000000 000000000
Background block errors  : 000000006 000000001 000000014 000000001
ESR  [%]                 :      0.14      0.14      4.54      4.54
SESR [%]                 :      0.00      0.00      0.00      0.00
BBER [%]                 :      0.00      0.00      0.02      0.02
Available time           : 000001344 000000684 000000308 000000022
Unavailable time         : 000000242 000000421 000000797 000000043
--------------------------------------------------------------------------------
CO_PM>
```

Please see the previous commands for the explanation of the different parameters.

5.7.3.4 <RESETG826> Command

This command clears the ITU-T G.826 error performance counters of the local SHDSL interface.

5.7.3.5 <RESETALLG826 N> Command

This command clears the ITU-T G.826 error performance counters of the specified SHDSL interface of the local device, all Regenerators connected to it and on the remote device.

5.7.3.6 <NETSTAT [LAN/WAN]> Command

This command shows the main network (LAN or WAN & MWAN) interface counters.

```
CO_PM>NETSTAT LAN
--------------------------------------------------------------------------------
Interface          LAN1      LAN2       INT
--------------------------------------------------------------------------------
Mode        :      DOWN      DOWN
In
  Octets    :         0         0         0
  Packets   :         0         0         0
  B/mcast   :         0         0         0
  Speed,kbit:         0         0         0
Size
  64        :         0         0         0
  65-128    :         0         0         0
  129-256   :         0         0         0
  257-512   :         0         0         0
  513-1024  :         0         0         0
  >1024     :         0         0         0
Out
  Octets    :         0         0         0
  Packets   :         0         0         0
```

```
  B/mcast   :         0         0         0
  Speed,kbit:         0         0         0
-------------------------------------------------------------------------------
CO_PM>
```

Parameter	Value	Description
Mode	LAN WAN	LAN status and speed is shown (DOWN, 100F, 10H, etc) WAN status and working mode is shown (DOWN, WAN1, MWAN1, etc)
IN	Octets Packets B/mcast Speed,kbit	Total number of octets (bytes) received by this interface incl. erroneous octets. Total number of packets received by this interface incl. erroneous packets. Total number of received broadcast and multicast packets. Average received layer 2 data rate through interface during last second.
Size	64 65-128 129-256 257-512 513-1024 >1024	A histogram of the received packets. It shows the frame size distribution.
OUT	Octets Packets B/mcast Speed,kbit	Total number of octets (bytes) sent by this interface. Total number of packets sent by this interface. Total number of sent broadcast and multicast packets. Average sent layer 2 data rate through interface during last second.

The INT interface (internal) counters are a special case. It's in and out directions are reversed in comparison to any other interface. For example, if frame enters LAN1 and leaves modem through WAN1, it will be counted as in for LAN1 and out for WAN1. But if frame enters LAN1 and is forwarded to INT, it will be counted as in by both LAN1 and INT.

Counters displayed by the NETSTAT command is a subset of the RMON group 1 counters. More interface counters may be seen in SNMP tables defined by RFC1213-MIB, IF-MIB and RMON-MIB.

5.7.3.7 <NETERR [LAN/WAN]> Command

This command shows the main network (LAN or WAN & MWAN) interface error counters.

```
CO_PM>NETERR WAN
-------------------------------------------------------------------------------

Interface          WAN1      WAN2      WAN3      WAN4     MWAN1     MWAN2
-------------------------------------------------------------------------------

In
  Bad octets:         0         0         0         0         0         0
  Discards  :         0         0         0         0         0         0
  Undersize :         0         0         0         0         0         0
  Oversize  :         0         0         0         0         0         0
  Fragments :         0         0         0         0         0         0
  Jabber    :         0         0         0         0         0         0
  MAC error :         0         0         0         0         0         0
  Bad FCS   :         0         0         0         0         0         0
Out
  FCS error :         0         0         0         0         0         0
  Deferred  :         0         0         0         0         0         0
  Collisions:         0         0         0         0         0         0
  .Late     :         0         0         0         0         0         0
  .Excessive:         0         0         0         0         0         0
  .Single   :         0         0         0         0         0         0
  .Multiple :         0         0         0         0         0         0
Pause
  In pause  :         0         0         0         0         0         0
  Out pause :         0         0         0         0         0         0
-------------------------------------------------------------------------------

CO_PM>
```

Parameter	Value	Description
IN	Bad octets	Total number of octets (bytes) received with error.
	Discards	Total number of discarded packets even when no error.
	Undersize	Total number of received packets with size <64 bytes (68 when tagged).
	Oversize	Total number of received packets with size >2040 bytes (2044 when tagged).
	Fragments	Received packets that were undersized and had either FCS or alignment Error.
	Jabber	Received packets that were oversized and had either FCS or alignment Error.
	MAC error	Total number of packets that were dropped due to hardware errors in receiver
	Bad FCS	Total number of received frames that had bad FCS (Frame Check Sequence).
OUT	FCS error	Total number of transmittet octets (bytes) with error.
	Deferred	Total number of discarded packets even when no error.
	Collisions	Total number of collisions:
	Late	Number of late collisions.
	Excessive	LAN half-duplex, number of dropped frames due to excessive number of coll..
	Single	LAN half-duplex, number of successfully transmitted frames due to single coll..
	Multiple	LAN half-duplex, number of successfully transmitted frames due to multiple collisions.
Pause	In pause	LAN links, Number of received MAC pause frames (Flow control).
	Out pause	LAN links, Number of sent MAC pause frames.

5.7.3.8 <RESETNETSTAT> Command

This command resets the statistics from the commands NETSTAT and NETERR.

5.7.3.9 <LINKSTAT> Command

This command shows an actual quick status of the whole link.

```
--------------------------------------------------------------------------------
        DSL 1
--------------------------------------------------------------------------------
          CO link up
     RR1 (N) link up
     RR1 (C) link up
          CP link up
--------------------------------------------------------------------------------
CO_PM>
```

5.7.3.10 <LINKALARM> Command

This command shows the actual alarm status for all units connected over SHDSL.

```
--------------------------------------------------------------------------------
  Local Alarm: Major
 -------------------------------------------------------------------------------
  DSL 1               DSL 2
 -------------------------------------------------------------------------------
                      RR01 Major
                      CO   Major
 -------------------------------------------------------------------------------
CO_PM>CO_PM>
```

5.7.3.11 <ALARMLOG [N]> Command

This command displays the alarm log (list of all alarms that were detected) for the specified SHDSL interface.

```
--------------------------------------------------------------------------------
      Time ago | Unit   | Event   | Description
--------------------------------------------------------------------------------
        04:45s | LOCAL | E1-2    | LOS-S ----- BER-S ----- -----
        04:18s | RR 1   | N-SIDE | LOS    ----- ----- ----- ----- LOOP2  ------
```

```
        04:16s | CO    | E1-1   | ----- ----- ----- ----- -----
--------------------------------------------------------------------------------
CO_PM>
```

Option: C – clears the Alarm log

Time ago - Time since the alarm was detected.
Unit - Unit in link, that reported about the alarm.
Event - Interface of the unit, that detected the alarm.

5.7.3.12 <LINKDIAG> Command

The <LINKDIAG> command displays important parameters of DSL link for local unit, remote unit and for connected repeaters.

```
CO_06_FMM>LINKDIAG
Querying link data: DSL1(.) DSL3(.)
--------------------------------------------------------------------------------
 DSL  Unit       NM    G.826(ES)  Status  Alarms      Description
--------------------------------------------------------------------------------
1     local (CO)  19.0 000000001  up      None        DSL1
      RR1-N       18.0 000000000  up      None        DSL2
      RR1-C       18.0 000000001  up                  DSL1
      remote(CP)  18.0 000000000  up      Minor       DSL1
--------------------------------------------------------------------------------
2     local (CO) ---.- 000000000  pre act LOSW        DSL2
--------------------------------------------------------------------------------
CO_06_FMM>
```

Parameter	Value	Description
DSL	1 ... 2	Number of DSL channel counted on local unit
Unit	local remote RRx-N RRx-C	The unit on which the LINKDIAG command executed Remote unit "N" and "C" side of Repeater with number x. X always counted from the Master side. "N" side is connected to Master, while "C" side is connected to Slave
Master / Slave	CO CP	Unit acts as Master modem Unit acts as Slave modem
NM	dB	Noise Margin
G.826(ES)	ES	Number of seconds with errors. According to G.826
Status	up down pre act act	Link is UP Link is Down Link is preparing for activation Link is activating
Alarm	None Minor Major LOSW	No Alarm present on the unit Unit has minor alarm Unit has major alarm Loss of Word on DSL link
Description	ifAlias	Interface Description

5.7.3.13 <M> Command

After this command is entered the device jump to and displays the main menu.

5.7.4 Fault and Maintenance Management Menu

After typing “2” in the main menu and pressing <enter>, the following message is displayed:

```
Fault and maintenance management activated
Enter 'M' to return to MAIN, or 'H' for HELP information

CO_PM>
```

5.7.4.1 <H> Command

Type <H> and the monitor lists all available commands in the fault and maintenance sub-menu. If you type H [command] you will get additional help on [command].

```
CO_FMM>H
------------------------------------------------------------------------------
Type 'H [command]' to get additional help on [command]
NM                        Trace xDSL noise margin
LINKNM                    Trace xDSL noise margin of all accessible units
LINKALARM                 Display link alarms of all xDSL channels
ALARMLOG [N]              Display the link alarm log
ALARMLOG C                Clear the link alarm log
LINKDIAG                  Trace xDSL status of all accessible units
STATUS                    Show current DSL working parameters
STATUS T                  Show current DSL working parameters continuously
STATUS L                  Show current DSL and LINK payload parameters
STATUS ETH                Show Ethernet status
STATUS RADIUS             Show RADIUS server status and parameters
LOOP2 [N:[A/R]] [ON/OFF] Starts/stops the remote loopback at Nth xDSL interface
ALARM                     Display alarms
ALARM T                   Display alarms continuously
ACO                       Show alarm cutoff configuration
ACO [GROUP] [ON/OFF]      Change alarm indication for alarm group GROUP
MACTABLE C                Clear MAC table
MACTABLE [1-8/OTHER/Port]Print MAC table for VLAN/port
MACTABLE                  Print all MAC table entries
STARTAL [N]               Toggles Nth xDSL channel the analog loopback ON/OFF
RESTART [N]               Restart Nth xDSL channel
RESET                     Reset modem
CONFIRM                   Confirm running configuration
BACKUP                    Backup running configuration
RESTORE                   Restore startup configuration from backup
DIFF [N/R/S/B] [N/R/S/B] Show difference between configurations
DUMP [N/R/S/B]            Dump selected configuration
LOAD                      Load configuration via XModem
TLM                       Show external alarm status
TLM D                     Show external alarm reaction
TLM S [N:Rnn-Rkk] [ABC]  Set up external alarm reaction
TLM C                     Clear external alarm table
LOG                       Show non-volatile log messages
LOG C                     Clear non-volatile log
SOFTUPDATE                Update software
TFTP [CMD] [ARG1][ARG2]  Perform maintenance over TFTP
SOFTCONFIRM               Confirm uploaded software
SOFTINFO                  List loaded software
PING x.x.x.x              PING host
LINKSTAT                  Display link status of all xDSL channels
RSTP [CONF/STATE]         Show RSTP state/configuration
MODEMVIEW                 Collect modem configuration
SD SNAPSHOT               Make software snapshot on SD card
SD DIR                    Display SD card contents
SD DEL [NAME]             Delete file from SD card
SD SAVE [N=0..9]          Save startup configuration
SD LOAD [N=0..9]          Load startup configuration
SD BOOT [ON/OFF]          Enable/Disable SD card boot mode
SD STATUS                 SD card status
APPLY [ALL/GROUP]         Apply changes to running configuration
CONNECT [N:[1-13/R]]      Establish connection to remote unit
LINK [NN]                 Establish local connection
LINKCLEAR                 Exit all local connections
M                         Return to Main Menu
H                         Show available commands
------------------------------------------------------------------------------
```

```
CO_FMM>
```

5.7.4.2 <NM> & <LINKNM> Command

The <NM> command displays the ITU-T G.991.2 Noise Margin. It means the maximum possible increase in the Noise Margin for which the BER is expected to be not less than 10^{-7} [dB].

```
CO_FMM>NM
Channel:   DSL1     DSL2
SHDSL NM:   10.5     11.5 dB
SHDSL NM:   10.5     11.5 dB
CO_FMM>
```

The number of columns is equal to the number of SHDSL channels of the device.
The <LINKNM> command displays the noise margin of a complete link (CO, RR and CP).
A normal quality of a SHDSL data transmission is possible for NM ≥ 6 dB.

5.7.4.3 <STATUS> Command

The <STATUS> command displays the actual status of the SHDSL or SFP transceiver.

```
CO_FMM>STATUS
------------------------------------------------------------------------------
Status                :       DSL1       DSL2
------------------------------------------------------------------------------
I/F mode              :         CO         CO
SYNC                  :          -          -
SEGD                  :          -          -
Power backoff         :        0.0        0.0                      dbm
Far end power backoff :        0.0        0.0                      dbm
Loop attenuation      :        0.0        0.0                      dB
NMR                   :        0.0        0.0                      dB
Bitrate               :          0          0                      kbit/s
SRU #                 :          0          0
Active sync. source   :   Internal   Internal
------------------------------------------------------------------------------
Temperature           :    39.750 C
------------------------------------------------------------------------------
CO_FMM>
```

Option: T – update the table continuously.
Option: L – show the DSL and Link parameters. For the STATUS L explanation please see the CONFIG command explanations.

Parameter	Value	Description
I/F mode	CO CP	The interface is in the Master mode The interface is in the Slave mode
SYNC	1 - (0)	Synchronization in the SHDSL line is established Synchronization in the SHDSL line is absent
SEGD	1 0 -	Transmitted data over the SHDSL line are valid Transmitted data over the SHDSL line are not valid Data are not received
Power backoff	N	Output signal power [dBm]
Far end power backoff	N	Output signal power [dBm] remote side
Loop attenuation	N	Attenuation in the loop [dB]
NMR	N	Maximum possible increase in the noise margin for which the BER is expected to be not less than 10^{-7} [dB]
Bitrate	N	Data transmission rate of the SHDSL line [kbit/s]
SRU #	N	Number of regenerators in the system
Active sync. source	External Internal	External sync Internal sync source
Temperature	N	Unit temperature [C°]

5.7.4.4 <STATUS ETH> Command

This command displays parameters of the Ethernet ports, the rate and the operation mode.

```
CO_FMM>STATUS ETH
LAN1 speed/duplex: 100 FULL
LAN2 speed/duplex: ---
CO_FMM>CO_FMM>
```

5.7.4.5 <STATUS SFP> Command

This command displays parameters of the SFP Transceiver.

```
CO_FMM>STATUS SFP
--------------------------------------------------------------------------------

Interface            LAN1
Description
Module Information
 Module Type      :  ---
 Module PN        :  ---
 Module REV       :  ---
 Vendor Name      :  ---
 Vendor ID        :  ---
Module Status
 Temperature      :  ---              C
 Voltage          :  ---              V
 Bias current     :  ---             mA
 RX Power         :  ---             mW
 TX Power         :  ---             mW
--------------------------------------------------------------------------------

CO_FMM>
```

5.7.4.6 <STATUS EXT> Command

This command displays parameters of the serial RS-232/422/485 interface.

```
CO_FMM>STATUS EXT
-----------------------------------------------
 Card     Cable   RTS  CTS  DCD  DTR  DSR  LL
-----------------------------------------------
 1.RS232  RS-232  OFF  OFF  OFF  OFF  OFF  ---
-----------------------------------------------
 Temperature :    41.250 C
-----------------------------------------------
CO_FMM>
```

5.7.4.7 <STATUS RADIUS> Command

The <STATUS RADIUS> command displays the actual status of RADIUS servers

```
CO_FMM>STATUS RADIUS
--------------------------------------------------------------------------------
Status                :       Server 1             Server 2
--------------------------------------------------------------------------------
Status                :       Connected            Not connected
Server IP             :       255.255.255.255      255.255.255.255
Server port           :       1812                 1812
Shared key            :       entered              empty
Retries               : 2
Timeout, seconds      : 2
--------------------------------------------------------------------------------
CO_FMM>
```

Parameter	Value	Description
Status	Connected Not connected	Client has a connection with RADIUS server Radius server is not configured or not responding
Server IP	IP Address	IP address of RADIUS Server
Server port	0-65535	UDP Port, the RADIUS server is listen on for incoming connections
Shared key	Entered Empty	Shared key is present in the client Shared key is not present in the client
Retries	0-10	Number of retries, the client will use to authenticate the user on both RADIUS servers. 0 means no attempts.
Timeout, seconds	1-5	Time interval between authentication attempts.

5.7.4.8 <LOOP2 [N:A/R] [ON/OFF]> Command

This command activates/deactivates the remote loop back on the line interface.

The parameter N:A sets the number N of the DSL interface and the device address (as in the CONNECT command). The parameters N=1..13 activates the loop back on the Regenerator, whose number is specified by the value of N. The regenerators are numbered, starting from the Master device.The parameter N=R activated the remote loop back on the remote device.

```
CO_FMM>LOOP2 1:R ON
Loop2 set is initiated.
Loop2 is successfully set.
CO_FMM>LOOP2 1:R OFF
Loop2 reset is initiated.
Loop2 is successfully cleared.
CO_FMM>
```

5.7.4.9 <ALARM> Command

The <ALARM> command displays the actual alarm status of the local device.

```
CO_FMM>ALARM
--------------------------------------------------------------------------------

Alarm status  :  DSL1  DSL2
--------------------------------------------------------------------------------

LOS           :    on    on
LOSW          :    on    on
SEGD          :   off   off
BER-H         :   off   off
ALB           :   off   off
SEGA          :   off   off
LOOP2         :   off   off
RCONF         :   off   off
--------------------------------------------------------------------------------

Ethernet                                Maintenance
--------------------------------------------------------------------------------

LOS-E         :  off                    HW-F  :   off
                                        DSL-F :   off
                                        SW-MNT:   off
--------------------------------------------------------------------------------

CO_FMM>
```

Option: T – enable the continuous updating of the table with actual alarm status.

Definitions (Ethernet)	
LOS-E	Loss of signal on the Ethernet interface
Definitions (SHDSL)	
LOS	Loss of signal in SHDSL
LOSW	Loss of signal or frame alignment in SHDSL (loss wire)
SEGD	A failure in the line (segment degradation)
BER-H	The block error rate in the line is according to G.826 ≥ 30%
ALB	Analogue loop back is active
SEGA	Errored data or errored frame alignment (segment alarm)
NM	Noise Margin < NM threshold
LA	Loop Attenuation > LA threshold
LOOP2	A loop is activated on the line interface of a remote device in the direction of the local device
RCONF	Configuration of the remote device is not compatible with the configuration of the local device (for example, the local device is configured to transmit Ethernet data, while the remote device is configured to transmit two E1 streams)
Definitions (Maintenance):	
HW-F	Hardware failure
DSL-F	DSL failure
SW-MNT	Software maintenance operation is in progress. If there is no alarm, 'off' is written in this line. Other values for this alarm: UPD: Software update is active. ERR: Software update ended with error and software image is corrupted. NEW: Software download ended successfully, reboot is needed. NCONF: Software image needs to be confirmed with SOFTCONFIRM command.

Table 5.3 <ALARM> definitions

5.7.4.10 <ACO [GROUP ON/OFF])> Command

The <ACO> command (Alarm Cut Off) without additional parameter shows deactivated alarm indications (LED and relays).

```
CO_FMM>ACO
ETHERNET
CO_FMM>
```

The <ACO [GROUP ON/OFF]> command activates/deactivates a GROUP for alarm indications.

```
CO_FMM>ACO ETH1 OFF
NONE
CO_FMM>ACO ETH1 ON
ETHERNET
CO_FMM>
```

Available alarm groups:

GROUP	Description
ETH1 or ETHERNET1	1st Ethernet port
ETH2 or ETHERNET2	2nd Ethernet port
ETH3 or ETHERNET3	3rd Ethernet port
ETH or ETHERNET	All Ethernet ports
DSL1 or SHDSL1	1st DSL channel
DSL2 or SHDSL2	2nd DSL channel
DSL or SHDSL	All DSL channels
RCONF	RCONF alarm

The deactivated alarms do not generate any urgent or non-urgent alarms (i.e. does not affect the colour of LEDs on the front panel and alarm relay status).

Note: By default the Ethernet alarm LEDs are blocked in all configurations.

By typing this command, the GROUP parameter can not contain several alarm groups. Example: if it is necessary to deactivate the alarm status of the group ETH1 and DSL, enter the ACO command twice: first, with the parameter ETH1, and second, with the parameter DSL.

5.7.4.11 <MACTABLE> Command

This command shows the MAC address table of every interface. If MAC address is blocked by the MAC Filter Rule, it will be marked as "BLOCKED"

The command MACTABLE C clears the MAC table.

The command MACTABLE [Port] shows the entries only for a [Port], where Port represents any network interface according to NETCONFIG command. For example: LAN1, WAN2, MWAN1, INT.

The command MACTABLE [1-8] shows the entries only for any selected VLAN number. VLANs are according to the NETCONFIG command.

The command MACTABLE OTHER shows the entries for OTHER VLANs (with VID not matching one of VLAN 1..8.

First column is the MAC address. The second column is the originating interface where this MAC is learned from. Third column is VLAN number. Forth column indicates if MAC address is blocked.

```
CX_05_FMM>MACTABLE
00:0f:d9:10:45:84  MWAN1  VLAN1
00:0f:d9:06:83:20  MWAN2  VLAN1
00:e0:4c:69:23:41  MWAN2  VLAN1
00:0f:d9:05:3f:8d  MWAN1  VLAN1
00:0f:d9:06:77:91  INT    VLAN1
00:0f:d9:04:d3:95  MWAN1  VLAN1
00:0f:d9:10:21:77  MWAN1  VLAN1
00:90:f5:3e:7a:0b         VLAN1 BLOCKED
CX_05_FMM>
```

5.7.4.12 <STARTAL [N]> Command

This command starts/stops (toggles) the analogue loop back at the SHDSL line interface on the device with the number N.

```
CO_FMM>STARTAL 1
Analog loopback started
CO_FMM>STARTAL 1
Analog loopback stopped
CO_FMM>
```

Note: This command is used in the Master mode. Detach the cable from the SHDSL connector before starting the analogue loop back.

5.7.4.13 <RESTART [N=1..2]> Command

This command restarts the corresponding SHDSL channel. First it causes the loss of sync between modems which later will be restored.

```
CO_FMM>RESTART 1
Restarting channel 1
CO_FMM>
```

5.7.4.14 <RESET> Command

The <RESET> command restarts the device.

5.7.4.15 <CONFIRM> Command

This command confirms the running configuration and writes it to the startup configuration. As a result, after confirmation of the configuration variables changes in all groups, they will be written from the running configuration into the startup configuration.

```
CO_FMM>CONFIRM
Current running configuration is confirmed and written to
startup configuration in EEPROM
```

5.7.4.16 <BACKUP> Command

This command is used to create a backup of the running configuration of the device in the EEPROM. As a result, the running configuration is written to the backup configuration.

```
CO_FMM>BACKUP
Current running configuration is written to
backup configuration in EEPROM
CO_FMM>
```

5.7.4.17 <RESTORE> Command

This command restores the startup configuration from the backup configuration, which was stored in the EEPROM. The modem should be restarted that restored values become valid.

```
CO_FMM>RESTORE
Restored startup configuration from backup configuration.
Reset modem for all changes to take effect
CO_FMM>
```

5.7.4.18 <DIFF N/R/S/B N/R/S/B> Command

This command displays differences between up to four configurations: New, Running, Startup, or Backup.

```
CO_FMM>DIFF R B
------------------------------------------------------------------------
Running configuration     Backup configuration
------------------------------------------------------------------------
VLAN.VLANMASK.3
00 01                   | 00 07
------------------------------------------------------------------------
CO_FMM>
```

The command displays the name of the difference parameter and data from two configurations. In the above example one can see that the VLANMASK parameter of interface 3 (WAN2) of the VLAN group in the running configuration differs from the backup configuration. If there are no differences, the result is presented as follows:

```
CO_FMM>DIFF N R
------------------------------------------------------------------------
New configuration         Running configuration
------------------------------------------------------------------------
--- No differences ---    --- No differences ---
------------------------------------------------------------------------
CO_FMM>
```

5.7.4.19 <DUMP N/R/S/B> Command

This command displays the dump of the corresponding configuration: New. Running, Startup or Backup.

```
CO_FMM>DUMP R
------------------------------------------------------------------------
Dump of running configuration
------------------------------------------------------------------------
NET.MAC_ADDRESS
```

```
00 0F D9 00 10 03
M.DEVICE_ID
00 00 00 00 00 00 00 00 00 43 4F 4D 4D 4F 4E 00\
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00\
00
NET.MAC_SPEED
5A
SNMP.TRAPIP.0
00 00 00 00
SNMP.TRAPIP.1
00 00 00 00
SNMP.COMMUNITY
43 4F 4D 4D 4F 4E 00 20 60 00 00 13 00 02 B2 3C\
00 18 65 44 00 05 5E 2C FF FF FF FF 00 17 59 F8\
00
M.ALARM_CUTOFF
02
NET.IP
C0 A8 5A 14
NET.NETMASK
FF FF FF 00
NET.GATEWAY
C0 A8 5A 64
NET.PPPREMIP
C0 A8 5A 5A
PE1.G704.0
01
SE1.G704.1
01
PE1.CRC4DET.0
00
  ...

------------------------------------------------------------------------
CO_FMM>
```

The results of the command show the coded configuration of the device and can be copied from the terminal window into the notepad as well as saved on any data carrier. This txt file can be downloaded into a similar device with the help of the LOAD command via the XModem or 1K XModem protocols.

5.7.4.20 <LOAD> Command

The <LOAD> command downloads the configuration file obtained with the help of the DUMP command into a device via the XModem or 1K XModem protocols. For Windows 95 or above, this procedure can be performed with the help of the HyperTerminal program. By typing LOAD, the following text will be displayed in the terminal window:

```
CO_FMM>LOAD
Now upload configuration via XModem or 1K XModem
C
```

Select "Send File" in the Transfer menu. Select the protocol XModem or 1K XModem in the window which appears. Select the downloading configuration file and click the Send button.

If downloading is successful, a message will appear to reset the modem:

```
Configuration was loaded successfully.
For all configuration options to apply, type RESET to reset modem.
CO_FMM>
```

If the configuration file contained errors, a message with the line number in which the error was detected will be displayed. The configuration of the device in this case will not change.

5.7.4.21 <TLM> Command

The < TLM > command shows the external alarm status of Regenerators.

```
CO_FMM>TLM
Distant external alarms status
---------- Line 1 -------- Line 2 -------- Line 3 -------- Line 4 ----
```

```
     | ALM1 ALM2 ALM3| ALM1 ALM2 ALM3| ALM1 ALM2 ALM3| ALM1 ALM2 ALM3|
-------------------------------------------------------------------------
RR01 | off  off  off | off  off  off | off  off  off | off  off  off |
RR02 | off  off  off | off  off  off | off  off  off | off  off  off |
RR03 | off  off  off | off  off  off | off  off  off | off  off  off |
RR04 | off  off  off | off  off  off | off  off  off | off  off  off |
RR05 | off  off  off | off  off  off | off  off  off | off  off  off |
RR06 | off  off  off | off  off  off | off  off  off | off  off  off |
RR07 | off  off  off | off  off  off | off  off  off | off  off  off |
RR08 | off  off  off | off  off  off | off  off  off | off  off  off |
RR09 | off  off  off | off  off  off | off  off  off | off  off  off |
RR10 | off  off  off | off  off  off | off  off  off | off  off  off |
RR11 | off  off  off | off  off  off | off  off  off | off  off  off |
RR12 | off  off  off | off  off  off | off  off  off | off  off  off |
RR13 | off  off  off | off  off  off | off  off  off | off  off  off |
-------------------------------------------------------------------------
CO_FMM>
```

Option: D – shows the reaction of the external alarms of Regenerators.

```
CO_FMM>TLM D
Reactions on external alarms
---------- Line 1 -------- Line 2 -------- Line 3 -------- Line 4 ----
     | ALM1 ALM2 ALM3| ALM1 ALM2 ALM3| ALM1 ALM2 ALM3| ALM1 ALM2 ALM3|
-------------------------------------------------------------------------
RR01 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR02 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR03 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR04 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR05 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR06 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR07 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR08 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR09 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR10 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR11 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR12 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR13 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
-------------------------------------------------------------------------
CO_FMM>
```

Option C - Clears the status of the TLM table.

5.7.4.22 <TLM S [N:[Rnn-Rkk]] [ABC]> Command

This command sets some LTU reaction on external alarms of Regenerators.

N: Selected line

Rnn - Rkk: Regenerator or the range of regenerators to set reaction for.
Example: 'R1', 'R9', 'R04', 'R1-R4', 'R07-R09'.

ABC: List of reactions. Must be a string of three digits, each from 0 to 3. First digit corresponds to the first alarm, second - to second, third - to third.
Possible Values:
0 - no reaction.
1 - LTU will show this alarm by 'TLM' command.
2 - LTU will indicate minor remote alarm and show this alarm by 'TLM' command.
3 - LTU will indicate major remote alarm and show this alarm by 'TLM' command.

```
CO_FMM>TLM S 1:R1 213
Reactions on external alarms
---------- Line 1 -------- Line 2 -------- Line 3 -------- Line 4 ----
     | ALM1 ALM2 ALM3| ALM1 ALM2 ALM3| ALM1 ALM2 ALM3| ALM1 ALM2 ALM3|
-------------------------------------------------------------------------
RR01 | MIN  RES  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR02 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR03 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR04 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR05 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR06 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR07 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR08 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR09 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
```

```
RR10 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR11 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR12 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
RR13 | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ | MAJ  MAJ  MAJ |
-------------------------------------------------------------------------
CO_FMM>
```

5.7.4.23 <LOG> and [LOG C] Command

The command <LOG> shows a record about all commands and events that are stored in non-volatile memory. The command <LOG C> clears the record (log).

5.7.4.24 <SOFTUPDATE> Command

This command downloads the new software into the device memory by using the XMODEM or 1K XMODEM protocol. The SOFTUPDATE command downloads only the second version of the software into the flash memory. During the new software downloading the analysis of the % symbols is not performed.

```
CP_FMM>SOFTUPDATE
Flash manufacturer: Spansion
      Flash device: S29AL016D(02)
     Start address: 0x1000000
        Flash size: 2048 KB
Now upload program via XModem or 1K XModem
CCC
```

After the new software is successfully downloaded a message is displayed to restart the modem. If the downloading failed, a message is displayed too and the modem returns to the usual operation mode. (The operator can try again to download the software.) If the downloading was interrupted, the software is most likely damaged. In this case the restart will result in the loading the first version of the software, that is correct in the memory.

5.7.4.25 <TFTP [CMD] [ARG1][ARG2]> Command

This command allows to perform some maintenance operations over TFTP. CMD operations can be:

- SOFTUPDATE: Update software from TFTP server. In this case ARG1 should contain the IP address of the TFTP server and ARG2 should contain the path to the file on server.
- DUMP: Sends the startup configuration to the TFTP server. In this case ARG1 should contain the IP address of the TFTP server and ARG2 should contain the path to file where the configuration should be stored.
- LOAD: Download the startup configuration from the TFTP server. In this case ARG1 should contain the IP address of the TFTP server and ARG2 should contain the path to file with the configuration.
- SET: Set the TFTP protocol options. ARG1 specifies the option name and ARG2 the new value for this option. Following options are supported: TIMEOUT (the time the device will wait for a reply from the TFTP server) and RETRY (the number of times the device will retry the operation).
- SHOW: Show the current TFTP settings (timeout and retry)

Examples:

- TFTP SHOW
- TFTP SOFTUPDATE 172.16.53.1 APP.BIN
- TFTP LOAD 172.16.53.1 ltu/backup_cfg.txt
- TFTP DUMP 172.16.53.1 ltu/current_cfg.txt
- TFTP SET TIMEOUT 10
- TFTP SET RETRY 1

5.7.4.26 <SOFTCONFIRM> Command

This command confirms the new version of the software. After downloading the new software, a counter is switched on and starts of the running software. If this software is not confirmed with the help of the <SOFTCONFIRM> command after the restart, it will not be valid.

```
CO_FMM>SOFTCONFIRM
Software confirmed
CO_FMM>
```

5.7.4.27 <SOFTINFO> Command

This command displays some information about the software, which are stored in the current device. Any device can have two stored software copies (different versions are possible). One copy of the software is started after switching power on, while the other is a backup software.

```
CP_FMM>SOFTINFO
1:   ver.: 1.1.3, date: 2.6.2006, length:  328k, CRC OK, fixed
2: * ver.: 1.1.4, date: 3.7.2006, length:  330k, CRC OK, confirmed
CP_FMM>
```

The asterisk shows the running downloaded version (starts after power on).
ver – The number of the software version.
date – The date of the software creation.
length – The size in bytes.
CRC OK/FAIL – A label showing if the software is damaged or not.
The software status is displayed at the end of the corresponding line:
fixed – First basic software. Cannot be downloaded, does not require confirmation.
just loaded – Downloaded second software.
not confirmed – Non-confirmed second software.
confirmed – Confirmed second software.

5.7.4.28 <PING x.x.x.x> Command

This command will PING any remote IP address. It sends an ICMP ECHO request message and wait for the corresponding ICMP ECHO reply message. This command will not ping the own device IP adress.

```
CP_FMM>PING 192.168.1.11
```

5.7.4.29 <MODEMVIEW> Command

This is a single command that collects and displays the modem configuration and status in a readable format. It is helpful to get an overview of the modem with just one command.

5.7.4.30 <SD SNAPSHOT> Command

This command generates the SNAPSHOT DAT, APP.BIN, LDR_xTU.BIN and STARTUP.CFG files in the O3MF directory on the SD card. This cmd is only available if the SD card is inserted.

5.7.4.31 <SD DIR> Command

This command shows the content of the SD card. This cmd is only available if the SD card is inserted.

5.7.4.32 <SD DEL [NAME]> Command

This command allows to delete files from the SD card. This cmd is only available if the SD card is inserted.

Example:

```
CO_01_FMM>SD DEL /O3MF/APP.BIN
CO_01_FMM>
```

5.7.4.33 <SD SAVE [N=0..9]> Command

The <SD SAVE> command generates a configuration file and saves it to the SD card. The SD SAVE <CR> generates the STARTUP.CFG file while SD SAVE x<CR> generates the desired PROFILEx.CFG file. This cmd is only available if the SD card is inserted.

5.7.4.34 <SD LOAD [N=0..9]> Command

The <SD LOAD> command downloads the configuration file from the SD card to the unit. The <SD LOAD> selects the STARTUP.CFG file while <SD LOAD x> selects the desired PROFILEx.CFG file.

5.7.4.35 <SD BOOT [ON/OFF]> Command

The <SD BOOT> command enables/disables the automatically SD card Software Upgrade feature during the boot sequence. If this feature is activated (SD BOOT ON) the software will compare the SNAPSHOT.DAT, APP.BIN, LDR_xTU.BIN and STARTUP.CFG files with the software and configuration files from the unit during the boot sequence. If any differences will be detected the corresponding software / configuration file from the SD card will be downloaded to the unit.

5.7.4.36 <SD STATUS> Command

The <SD status> command shows if the SD BOOT is enabled and the SD card information

```
CO_01_FMM>SD STATUS
SD Boot   : OFF
Card type : SDHC
Capacity  : 3781M
Blocks    : 7744512
Read err  : 0
Write err : 0
FAT       : FAT32
Partition size : 3768M
Free space     : 3766M
Snapshot files
        /APP.BIN, correct
        /LDR_LTU.BIN, correct
        /STARTUP.CFG, correct
CO_01_FMM>
```

SD STATUS	
SD BOOTs	Status of the automatically SD card Software Upgrade feature
Card type	Type of the inserted SD card
Capacity	Capacity of the SD card
Blocks	Number of the usable blocks on the SD card
Read err	Number of read errors
Write err	Number of write errors
FAT	Fileformat used on the SD card
Partition size	Partition size on the SD card
Free space	Usable Space on the SD card
Snapshot files	Status of every file that is checked during the boot sequence in case <BOOT ON> is activated. Correct indicates that the actual software / configuration file from the unit is equal to the file on the SD card.

5.7.5 Configuration Management Menu

After typing “3” in the main menu and pressing <enter>, the following message is displayed:

```
Configuration management activated
Enter 'M' to return to MAIN, or 'H' for HELP information

CO_CM>
```

The content of the configuration management menu mainly depends on the operation mode of the device. There are four possible modes of the device operation:

CO – All channels are in the Master mode, manual configuration.
CP – All channels are in the Slave mode, manual configuration.
CX – Some Channels are in Master, some channels are in Slave mode, manual configuration.
CA - Configuration of WAN streams is received from the SHDSL line, automatic config.

5.7.5.1 <H> Command

Type <H> and the monitor lists all available commands in the configuration management sub-menu. If you type H [command] you will get additional help on [command].

```
CO_CM>H
------------------------------------------------------------------------------
Type 'H [command]' to get additional help on [command]
SECURE [ON/OFF]          Change security mode
USERS                    List user accounts
USER [name]              Add user account
USER [name] DEL          Delete user account
USER [name] [+|-] [PRIV] Assign user access rights
USER [name] [IP] [subnet]Set IP access list for user
USER [name] [LOCAL/ALL]  Set all IP/ or local only user access
PASSWORD [user]          Set user password
AUTO [ON/OFF]            Set CA mode
CONFIG                   Display local configuration
CONFIG [N/R/S/B]         Display new/running/startup/backup configuration
MASTER [ON/OFF] [N]      Select Nth xDSL channel master/slave
EXT [ON/OFF] [N]         Turn Nth DSL channel Extended mode ON or OFF
BASERATE [M/AUTO] [N]    Set Nth DSL channel baserate to M*64k + 8k
PAM [4-128] [N]          Set Nth xDSL channel line coding
PAYLOAD [list] [N]       Set Nth xDSL channel payload
ANNEX [A,B,A/B] [N]      Set Nth xDSL channel Annex A or Annex B or Annex A/B
SETCLOCK [list] [N]      Set Nth xDSL channel clock source priorities
MULTIPAIR [2/OFF]        Select or turn off multipair mode
RESERVE [list]           Set the list of channels for the reserve group
ID [string]              Set/Clear device ID
RESPONSE [NN/OFF]        Set response ID
DEFAULT [0-4]            Set default configuration
DEFAULT EVERYTHING       Set everything to default configuration
DEFAULT DESC             Set default Description (ifAlias)
SERNUM                   Show serial number
GSCOMPAT [ON/OFF]        Set GS compatibility mode on and off
NMTHR [N/OFF]            Set Noise Margin alarm threshold
LATHR [N/OFF]            Set Loop Attenuation alarm threshold
PTMP [ADD|DEL] [IF]      Add/delete interface to PTMP network
PTMP SHOW                Show interfaces of PTMP network
MODE [N]                 Sets the number of DSL channels to N
LICENSE                  Show active licenses
LICENSE ADD [key]        Add software options
NET                      Network configuration menu
APPLY [ALL/GROUP]        Apply changes to running configuration
CONNECT [N:[1-13/R]]     Establish connection to remote unit
LINK [NN]                Establish local connection
LINKCLEAR                Exit all local connections
M                        Return to Main Menu
H                        Show available commands
------------------------------------------------------------------------------
CO_CM>
```

5.7.5.2 <SECURE ON/OFF> Command

This command activates/deactivates the advanced security. The basic security allows 2 users, ADMIN and USER. The Advanced Security software license allows up to eight users. Each user can have different access rights to command line interface (CLI) and SNMP commands. The optional access control list (ACL) is possible to set for every user additionally. The user will be able to access the WEB interface and the CLI only if source IP address belongs to the defined domain.
Starting from the software version 1.5.1, the Advanced Security option activates SSH and Radius protocol support.

Note: The SECURE ON feature needs a special LICENSE KEY that has to be ordered together with the unit.
Starting from the software version 1.5.2 no additional LICENSE KEY is required for activation of Advanced Security feature.

5.7.5.3 <USERS> Command

This command shows the list of users of the device with their control and access rights.

```
CO_CM>USERS
-------------------------------------------------------------------------------
Username Controls IP ACL
-------------------------------------------------------------------------------
ROOT ALL Local access only
WHEEL CONTROL,TEST,STATUS,CONFIG 192.168.1.64/30
NET C{SNMP,NET} 192.168.1.16/30
LAN S{LANC},C{LAN} 192.168.20.16/30
LINK CONTROL,TEST,S{LINKC},C{LINK} 192.168.20.24/30
WATCH S{LINK,LAN} Any IP
GUESTLINK S{LINKC},C{LINK} 192.168.2.16/30
-------------------------------------------------------------------------------
CO_CM>
```

5.7.5.4 <USER> Command

This command allows the control of various user parameters. You must have ADMIN rights to use this command.

Command	Description
USER [username]	Creates a user USERNAME and asks for a password
USER [username] DEL	Deletes user USERNAME
USER [username] [+/-] [PRIV]	Modify privileges for user USERNAME
USER [username] [IP] [net]	Set the IP range for user USERNAME. Net should be in range from 0 to 32. If no IP is set, no restrictions are applicable.
USER [username] LOCAL	Disable remote access for user USERNAME. This command is equal to USER [username] 0.0.0.0 32.
USER [username] ALL	Allow access from any IP address for user USERNAME. This command is equal to USER [username] 0.0.0.0 0.

Every user in the list has rights to control some parts of the device through the command line interface. The list of control points is empty for the new user. To change (to add or to delete) control points (Controls) the USER [USERNAME] [+|-] [PRIV] command is used. If “+” is selected, the one of the following privileges will be added. In case if “-“ is used, the one of the following privileges will be revoked.
All commands of the CLI are divided into 3 levels. Selection of upper level means that the commands from low levels will be selected too. Some commands are available for every user, they can’t be revoked.

Privileges

Hierarchy Levels			Description	Related commands	
Top Level	Group	Subgroup			
ALL			Commands of this level are available for everyone. No additional authorization is required	ALARM ALARM T DISCONNECT LINKCLEAR	TLM SENSOR ACO SOFTINFO
	CONTROL [CTRL]		Operation of remote devices	CONNECT	LINK
	TEST [T]		Test of the device	LOOP1 LOOP2 STARTAL RESTART	PING MACTABLE MACTABLE C BERT Submenu
	ADMIN [A]		Administration of the device	DIFF DUMP SERNUM LICENSE ACO change RESET BACKUP RESTORE LOAD TLM D TLM S TLM C SENSOR [N] [O/C] TFTP	SOFTUPDATE SOFTCONFIRM ID RESPONSE PASSWORD NMTHR LATHR LICENSE ADD DEFAULT EVERYTHING SECURE LOG USERS USER APPLY CONFIRM
	STATUS [S]	:LINK	Link status	G826 G826 C G826 E1 G826 E1 C ALLG826 LINKSTAT LINKALARM ALARMLOG	NM LINKNM STATUS STATUS T STATUS L STATUS EXT POWER DIAG
		:LINKC	All commands from LINK + reset of the counters	RESETG826 RESETALLG826	ALARMLOG C
		:LAN	Ethernet status	NETSTAT NETERR	STATUS ETH MACTABLE
		:LANC	All commands from LAN + reset of Ethernet counters and MAC table	RESETNETSTAT MACTABLE C	

ALL	CONFIG [C]	:VIEW	Displaying of device configuration	CONFIG NETCONFIG	COSCONFIG RSTP CONF
		:LINK	All commands from VIEW +line, E1 and Nx64 interface configuration	DEFAULT AUTO MASTER EXT BASERATE	E1CLOCK E1MODE POWER GSCOMPAT PTMP

			PAM PAYLOAD ANNEX SETCLOCK MULTIPAIR RESERVE G704 CRC4 AISDET AISGEN DSLTS WANTS	MODE N RSRATE RSFORMAT RSDUPLEX AUTOLOOP EXTCLOCK N64RATE WAN WANIDLE APPLY CONFIRM
	:LAN	All commands from VIEW + LAN configuration	NETDEFAULT RSTP DEFAULT RSTP STATE RSTP ... PBVLAN MODE [IF] VLAN QOS ALLOW VID	ETHSD FC IRATE ERATE CRATE COS PING APPLY CONFIRM
	:SNMP	All commands from VIEW + SNMP configuration	TRAPIP COMMUNITY SNMPSET SNMPACL	RMONALARM RMONEVENT APPLY CONFIRM
	:NET	All commands from VIEW + IP configuration	SETIP GATEWAY NETMASK MTU SYSLOG	SNTP APPLY CONFIRM PING

Note: The abridgements in braces “[ ]” can be entered instead of complete name. If group has been entered without subgroup definitions, all subgroups will become available. To define subgroup, type it after group name with “:” in the beginning of a subgroup. The WEB interface will follow the rights of CLI interface

Examples:

`USER TESTUSER + S:LINK,LANC` add privileges to show LINK status, LAN status and to clear LAN statistics for the TESTUSER (it should be created firstly)
`USER TESTUSER - S:LANC` remove privileges to clear LAN statistics for the TESTUSER
`USER TESTUSER + CONFIG` add privileges to change configuration for the TESTUSER

Access Control
All listed users have local access to CLI via RS232 interface. The remote access through Telnet and WEB can be granted from anywhere, from selected IP addresses, or canceled.

The `USER [USERNAME] [IP] [netclass]` command is used to define the IP domain.
The `USER [USERNAME] ALL` command is used to allow access from all IP addresses.
The `USER [USERNAME] LOCAL` command is used to disable access from all IP addresses.

5.7.5.5 <PASSWORD {users}> Command

This command sets the access password for users. With basic security, there are two users available: USER is a non-privileged, ADMIN is a privileged user. With advanced security, up to 8 users with arbitrary names are allowed.

PASSWORD ADMIN: sets password for the user ADMIN

PASSWORD USER: sets password for the user USER

```
CO_CM>PASSWORD USER
Enter password:
Confirm password:
Ok
```

Only the administrator can perform this command. The password length is not more than 11 symbols (advanced security 63 symbols). The password can contain Latin letters and digits.

Note: It is also possible to set an empty password (in this case, the password is not requested while opening the telnet session). This command sets the password only to access the device over the telnet protocol. When managing the devices via the USB interface, the password is not requested.

5.7.5.6 <CONFIG [N/R/S/B] > Command

The <CONFIG> command always displays the running configuration of the device. If a new configuration differs from the running one a warning is displayed. Options:

- N - Display New line configuration
- R - Display Running line configuration
- S - Display Startup line configuration
- B - Display Backup line configuration

```
CO_CM>CONFIG
--------------------------------------------------------------------------------

Running Line Configuration

--------------------------------------------------------------------------------

xDSL               DSL1          DSL2
  Mode          :  Master(HTU-C) Master(HTU-C)
  Extended rates:  OFF           OFF
  Line coding   :  PAM32         PAM32
  Baserate      :  89            89
  Annex         :  B             B
  Payload       :  WAN           WAN
  Clock source  :  Int           Int
  GS compatible :  OFF
--------------------------------------------------------------------------------

CO_CM>
```

Group of SHDSL parameters	
Mode	Master, Slave, Multipair All slave, configured by master All slave, MULTIPAIR xx, configured by master
Extended rates	Extended DSL feature ON/OFF
Line coding	Type of the line encoding (PAM128, PAM64, PAM32, PAM16, PAM8, PAM4)
Baserate	Data Transmission Rate on SHDSL line (BR*64kbit/s). Auto – adaptation mode
Annex	Transmission Mode (ANNEX A, ANNEX B, ANNEX AB)
Payload	Data Transmission interfaces: list of E1 and/or WAN streams
Clock source	Priority list of clock sources
GS compatible	Enables the Globespan (Conexant) compatibility

Table 5.4 All possible configurations of independent channels

The main operation modes are:

- Independent channels (CO, CP, CX)
- Multipair mode (CO, CP, CX)

The CONFIG table for the mode with independent channels is presented above.

5.7.5.7 <MASTER ON/OFF [N = 1..2]> Command

This command activates/deactivates the «MASTER» mode on the interface with the number N.

```
CP_CM>MASTER ON 1
```

Note: In a data transmission systems one device should be configured as a Master device, while the other as a Slave device.

5.7.5.8 <AUTO ON/OFF> Command

This command This command activates the modem in CA mode. This means that all SHDSL channels are set to “SLAVE” mode and getting most settings from SHDSL line.

5.7.5.9 <EXT ON/OFF [N = 1..2]> Command

This command activates/deactivates the standard and the extended G.SHDSLbis mode on the interface with the number N.

Note: The EXT ON feature needs a special LICENSE KEY that has to be ordered together with the unit.

In extended mode higher data rates and line codes (PAM4, PAM8, PAM16, PAM32, PAM64, PAM128) are available.

Standard mode **Command**	**Channel Coding**	**Min Baserate**	**Max Baserate**
PAM 16	PAM 16	3	60
PAM 32	PAM 32	12	89
Extended mode			
PAM 4	PAM 4	2	39
PAM 8	PAM 8	3	79
PAM 16	PAM 16	1	119
PAM 32	PAM 32	1	159
PAM 64	PAM 64	2	199
PAM 128	PAM 128	4	238

5.7.5.10 <BASERATE K/AUTO [N=1..2]> Command

This command sets the transmission rate K to the line SHDSL interface, where N is the number of the SHDSL interface. The data transmission is BASERATE * 64kbit/s.

WARNING

FOR LOW BASERATES YOU SHOULD USE THE LOWEST POSSIBLE NUMBER OF CODE LEVELS. FOR A STANARD BASED DEVICE USE PAM16 AND NOT PAM32.

On the Slave device, the <BASERATE AUTO> command adapts the rate of the Slave device to the rate of the Master device. In this case, PAM and Annex are automatically detected (opposite Annex in the <CONFIG> configuration AB appears, opposite PAM is Auto). The command does not change the Annex and PAM modes in the configuration. In the Slave mode, the <BASERATE AUTO> command automatically detects all configurations.

5.7.5.11 <PAM [16/32] [N]> or <PAM [4-128] [N]> Command

This command sets the number of levels in the line code. The following options are possible – 4,8,16, 32, 64 & 128 for EXT mode ON.

```
CO_CM>PAM 16
```

5.7.5.12 <PAYLOAD list/NONE [N=1..2]> Command

This command sets the list of streams transmitted over the SHDSL channel. N is the number of the SHDSL channel. The parameter list must be WAN (Ethernet) or NONE. The parameter NONE deactivates transmission of WAN over this SHDSL interface.

This command sets the list of streams transmitted over the SHDSL channel. N is the number of the SHDSL channel. The parameter list must be WAN (Ethernet) or NONE. The parameter NONE deactivates transmission of WAN over this SHDSL interface.

```
CO_CM>PAYLOAD WAN
CO_CM>PAYLOAD NONE
```

5.7.5.13 <ANNEX A/B/AB [N=1..2]> Command

This command enables the transmission standard G.991.2 ANNEX A or ANNEX B, where N is the number of the SHDSL interface. The ANNEX AB automatically selects the transmission standard.

5.7.5.14 <SETCLOCK list [N=1..2]> Command

This command sets the priority list of clock sources for the SHDSL channel, where N is the number of the SHDSL channel. The possible clock sources are:

- External sync source: EXT, EXTERNAL
- internal sync source: INT, INTERNAL

The external clock source should be either the first one in the priority list or be not used at all. The internal clock source should be the last one in the priority list. It is even not necessary to type it in the command.

```
CO_CM>SETCLOCK EXT
CO_CM>SETCLOCK INT
```

5.7.5.15 <MULTIPAIR [2/OFF]> Command

This command activates the multipair mode, which allows to merge DSL channels. Two channels can be merged into the multipair mode.

5.7.5.16 <RESERVE [list]>, <RESERVE [list] [list]> Command

This command allows combining SHDSL channels into groups in order to reserve them. Not more than 2 groups are possible in a system with 4 SHDSL channels. The reservation groups are called A and B groups. The parameter sets the list of channel numbers separated by a comma. To simplify configuration and maintenance of devices, any groups of successive channels can be reserved. To configure the reserve group, type the following command:

The parameter NONE deactivates reservation.

```
CO_CM>RESERVE NONE
```

5.7.5.17 <ID string> Command

This command is used to enter an identification number on the device (text containing no more that 12 symbols). This ID will be displayed on top the main menu. If the parameter is not written, the device ID will be empty.

5.7.5.18 <DEFAULT [0-4]> Command

The <DEFAULT N> command sets the default operation mode, where N is the mode number (there are four default operation modes).

- The DEFAULT 0 command sets the following mode: MASTER, PAM 32, BASERATE 89, ANNEX B, transmission Ethernet over SHDSL.
- The DEFAULT 1 command sets the following mode: MASTER, PAM 32, BASERATE 89, ANNEX B, transmission Ethernet over SHDSL.
- The DEFAULT 2 command sets the following mode: SLAVE, LINECODING AUTO, BASERATE AUTO, ANNEX A/B, transmission of Ethernet over SHDSL.
- The DEFAULT 3 command sets the following mode: MASTER, PAM 32, BASERATE 89, ANNEX B, transmission Ethernet over SHDSL.

5.7.5.19 <DEFAULT EVERYTHING> Command

This command sets default operation modes for line parameters (see the DEFAULT command) and for network parameters (see the <NETDEFAULT> command). The result of this command is similar to the result of two commands:
DEFAULT 0
NETDEFAULT

5.7.5.20 <DEFAULT DESC> Command

This command writes default Port Description (ifAlias)

```
CO_06_CM>DEFAULT DESC
CO_06_CM>
```

5.7.5.21 <POECONFIG> Command

This command displays the PoE configuration of the unit.

5.7.5.22 <POEPORT [ON/OFF] [N]> Command

This command switches PoE port ON or OFF on the PoE unit.

Syntax: POEPORT [ON/OFF] [N=1..2], where N is the number of the PoE port.

5.7.5.23 <SERNUM> Command

This command shows the production serial number of the unit.

5.7.5.24 <GSCOMPAT ON/OFF> Command

This command sets the Globespan (Conexant) compatibility mode on/off. This feature will also limit the baserate to 36 (PAM16).

5.7.5.25 <NMTHR> Command

The <NMTHR> command allows to setup the desired Noise Margin alarm threshold in dB.

Syntax: NMTHR [value], where value is in the range from 0...25
NMTHR OFF disables the Noise Margin alarm threshold function

5.7.5.26 <LATHR> Command

The <LATHR> command allows to setup the desired Line Attenuation alarm threshold in dB.

Syntax: LATHR [value], where value is in the range from 0...25
LATHR OFF disables the Line Attenuation alarm threshold function

5.7.5.27 <PTMP [ADD/DEL] [IF]> Command

This command helps to add or delete an interface to the Point-to-Multipoint group channel.
[IF] is the name of interface to add or delete:

- RS-1: RS-232 or RS-485
- WAN1-WAN4: WAN interface to transmit PTMP data through
- DSL1-DSL4: DSL interface transmitting WAN

DSL and E1 interface names are automatically converted to corresponding WAN channels by this command.

5.7.5.28 <PTMP SHOW> Command

This command shows the members of the Point-to-Multipoint group channels.

5.7.5.29 <MODE N> Command

The <MODE> command sets number of SHDSL interfaces system will operate with.

For example: The MODE 1 in a two-channel unit disables channel 2.

To setup this configuration parameter you should perform the following command sequence:
1. Apply and confirm all configuration changes
2. Issue MODE [N] command
3. RESET

After the reset unit will work with specified number of SHDSL channels.

5.7.5.30 <RSIP> Command

This command configures the RS<->IP (Serial to Ethernet) function of the modem.

Syntax: RSIP [I/O] [addr] [IF]
RSIP [{mode}/ON/OFF] [IF]
RSIP SIGNALING {sign} [IF]
RSIP BREAK [ON/OFF] [IF]

[I/O]: Defines which parameter to configure. Input (IN: local IP port that receive serial data packets) or Output (OUT: remote IP address to forward serial data packets).

[addr]: IP port or IP address and port. For Input (IN) address [addr] is just a port number. For Output (OUT) address [addr] is an IP address and port number, separated by a colon (:). For TCP Server mode only an IP address should be specified. The port number should be in range from 1024 to 65535 inclusively. Port numbers below 1024 may be used as well as port numbers

above 1024, but may conflict with another built-in services like SNMP or NTP. It's not recommended to use ports below 1024.

{mode}: Selects the IP protocol and mode. Possible values are: UDP (use UDP protocol), SERVER (work as TCP Server), CLIENT (work as TCP Client).

[ON/OFF]: Enables/Disables RS<->IP function

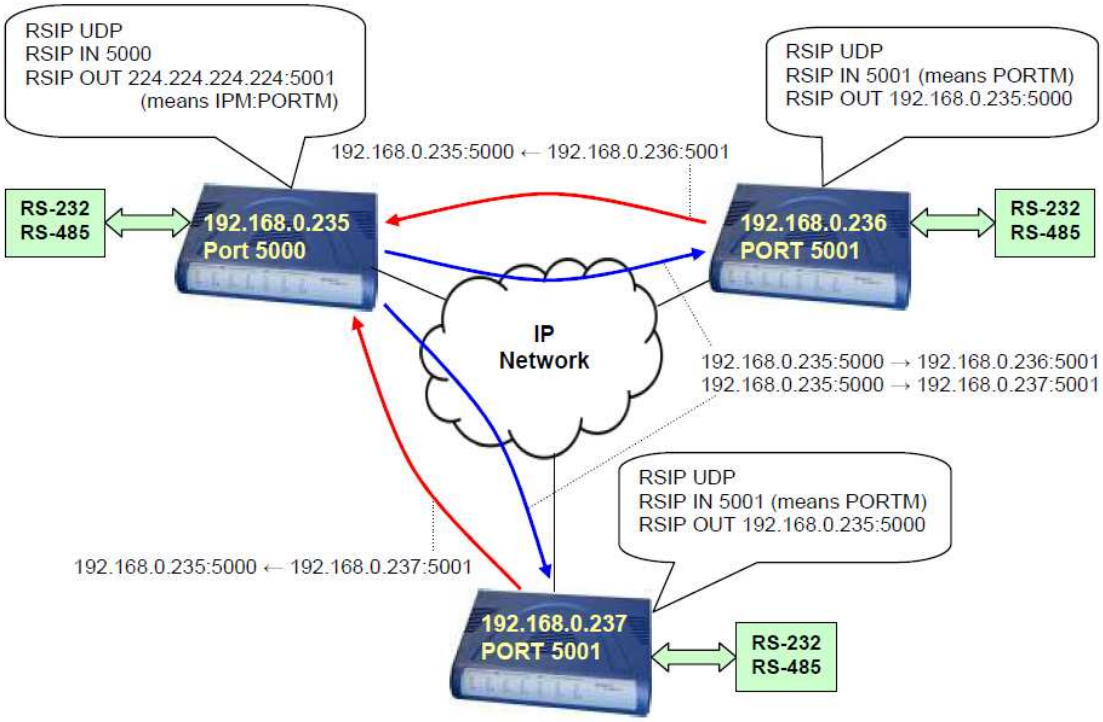
{sign}: Define the RTS/CTS signals operation mode and is only for RS-232 available. Possible values are: OFF (CTS & RTS signals are not used), LOCAL (TCP: When UP local RTS is looped to CTS), UDP (RTS is always looped to CTS), REMOTE (CTS input is transferred to the remote RTS output and vice versa). If communication is not established RTS is low. This mode works over both TCP and UDP protocols and should be enabled on both ends of connection simultaneously.

[IF]: Selects corresponding serial RS interface. Possible values are RS1 (for first RS interface). This parameter may be ommited when only one RS232/422/485 interface is available.

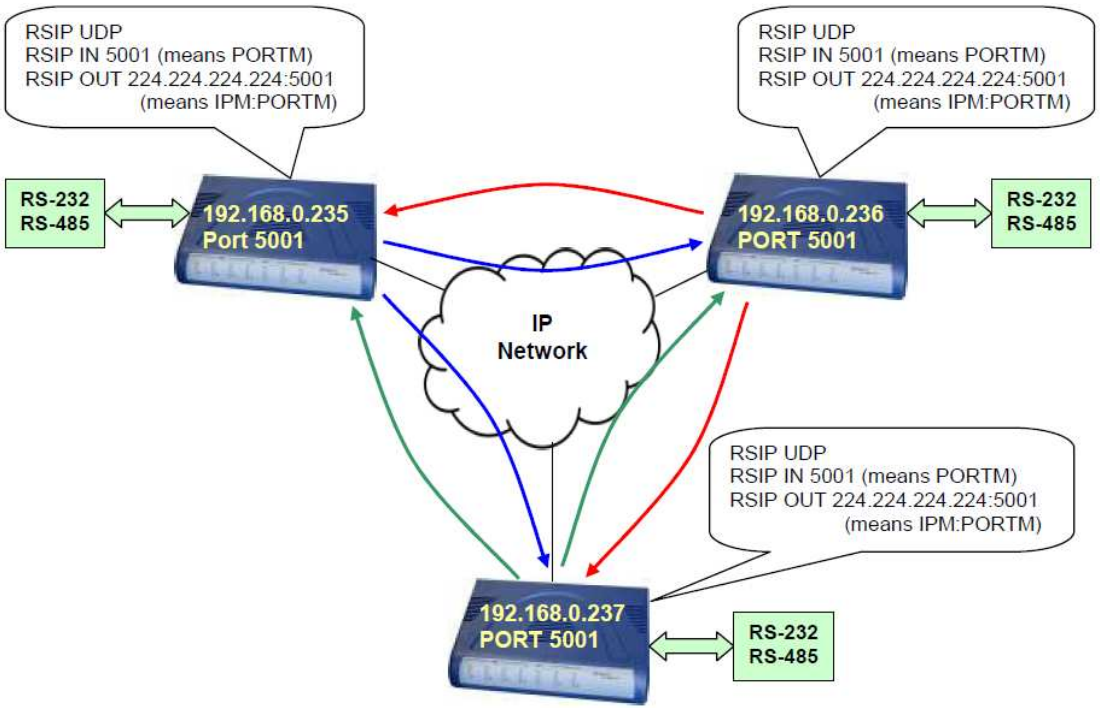
BREAK: Allows to switch ON/OFF the transmission of the BREAK condition. ON means to ransmit BREAK conditions through RSIP, OFF ignore the BREAK conditions. In this case BREAK conditions will appear as zero bytes in data stream.

Examples:
RSIP ON RS: Enable RS<->IP
RSIP UDP RS: Select UDP mode
RSIP IN 5000 RS: Means to select port 5000 for the reception of serial data packets
RSIP OUT 172.16.53.1:5000 RS: Select IP address 172.16.53.1 and port 5000 as address of the remote system where serial data will be transferred to. Only packets from this address will be accepted when received on listen port.

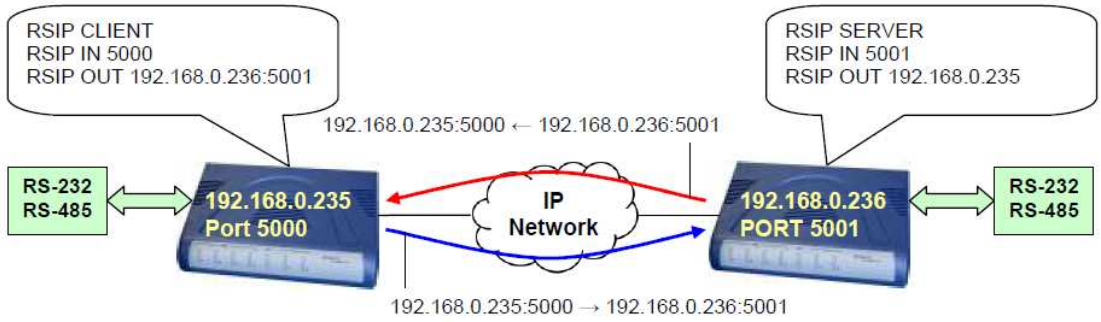
UDP Point to Multipoint (Multicast addresses are IP addresses in the range from 224.0.0.0 to 239.255.255.255):



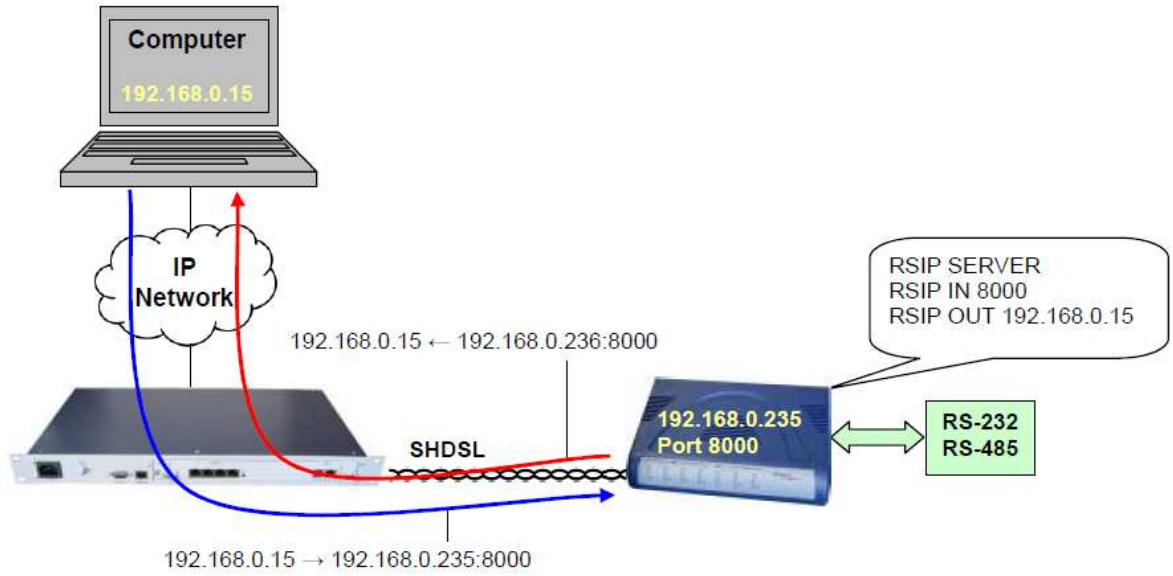
UDP Broadcast



TCP Point to Point



COM Server



5.7.5.31 <LICENSE> Command

This command shows the active licenses.

```
CP_CM>LICENSE
Current license status:
Extended PAM and baserates: Not activated
```

5.7.5.32 <LICENSE ADD> Command

This command activate a special functionality added by a license KEY, that you can get from the manufacturer.

5.7.5.33 <RSRATE [N]> Command

This command sets the bitrate of the serial interface.

```
CP_01_CM> RSRATE 115200
```

5.7.5.34 <RSFORMAT [Format]> Command

This command defines the RS-232/RS-485 data format. [Format] means:
Data bits: 5..8
Parity: N, E, O, M, S

- N - None
- E - Even
- O - Odd
- M - Mark
- S - Space

Stop bits: 1, 1.5, 2

```
CP_01_CM> RSFORMAT 8N1
```

5.7.5.35 <RSDUPLEX [F/H] Command

This command sets the operating mode of the RS-422/485 interface:

- F means FULLDUPLEX
- H means HALFDUPLEX

5.7.5.36 <RS [232/485] Command

This command defines the physical interface for the serial interface: RS-232 or RS-422/485.

5.7.5.37 <RS TERM [ON/OFF] Command

This command sets the line termination (120 Ohm) of the RS-422/485 on or off.

5.7.5.38 <NET> Command

The <NET> command allows to enter into the submenu for NET settings.

5.7.5.39 <H> Command

Type <H> and the monitor lists all available commands in the NET sub-menu. If you type H [command] you will get additional help on [command]:

```
CP_NET>H
--------------------------------------------------------------------------------
Type 'H [command]' to get additional help on [command]
NETCONFIG                 Show network configuration
NETCONFIG [N/R/S/B]       Show new/running/startup/backup network configuration
COSCONFIG                 Show CoS configuration
COSCONFIG [N/R/S/B]       Show new/running/startup/backup CoS configuration
RSTP DEFAULT              Show RSTP state/configuration
RSTP [CONF/STATE]         Show RSTP state/configuration
RSTP [BR/IF] [OPT] [N]    Set RSTP Bridge/Interface properties
RSTP [A..E] [ON/OFF]      Switch RSTP ON/OFF at PBVLAN A..E
PBVLAN [IF] [A..E/S]      Set port-based VLAN for the interface
MODE [IF] [ACC/TRUNK/MIX]Set mode of LANx interfaces: access, trunk, mixed
VLAN [IF] [1..8]          Set default VLAN index for access ports
QOS [IF] [0..7]           Set default QoS for access ports
ALLOW [IF] [VLAN list]    Set list of VLANS to allow on trunk interface
VID [1-8] ID              Assign VID to the VLAN specified
MACLIST SHOW              Show MAC filter settings
MACLIST SHOW [N/R/S/B]    Show new/running/startup/backup MAC list
MACLIST [IF] ADD [MAC]    Add MAC to the white list
MACLIST [IF] DEL [MAC/N] Delete MAC from the white list
MACFILTER [LAN1-5] [ON/OFF]Enable/disable MAC filtering
MACRULE [LAN1-5] [rule]   Set the MAC Filter behaviour
SETIP x.x.x.x             Set modem IP address
GATEWAY x.x.x.x           Set gateway IP address
NETMASK x.x.x.x           Set netmask
MTU [68..1500]            Set port INT MTU
WANIDLE [1/7E]            Select WAN idle pattern
ETHSD [MODE] [N=1-2]      Set Nth Ethernet port speed
FC [ON/OFF] [N=1-2]       Set Ethernet port flow control
IRATE [speed/OFF] [N=1-2]Set LAN port ingress rate limit
ERATE [speed/OFF]         Set modem egress rate limit
CRATE [speed] [CoS] [WAN]Set COS egress rate limit
COS [QOS/VLAN] [N] [0..3/OFF]Set QoS/VLAN to COS mapping
SNMP [V1|V2C|V3] [ON|OFF]Activate support for SNMP v1, v2c, v3
SNMPACL [1/2] [IP/OFF]    Set/delete SNMP poller IP addresses
TRAPIP [1/2] [IP/OFF]     Set/delete IP address for SNMP trap messages
TRAP [1/2] [V1/V2C]       Select v1/v2c for trap
TRAP [1/2] V3 [RO/RW]     Select v3 and user for trap
COMMUNITY                 Set SNMP community name
COMMUNITY [GET/SET/TRAP] Set SNMP GET/SET/TRAP community
SNMPSET [ON/OFF]          Enable/disable SNMP v1,v2c SET commands
SNMP [RO|RW] NAME         Set SNMPv3 user security name
SNMP [RO|RW] AUTH [MODE] Set SNMPv3 user authentication: MD5,SHA,NONE
SNMP [RO|RW] PRIV [MODE] Set SNMPv3 user privacy: DES,AES,NONE
RMONALARM N [ON/OFF]      Setup RMON alarm N
RMONEVENT N [ON/OFF]      Setup RMON event N
SNTP [1/2] [IP/OFF]       Set/delete SNTP server IP addresses
SNTP TZ [+/-]HH:MM        Set local time zone
DST SUMMER                Set Summer time rule
DST WINTER                Set winter time rule
DST [OFF/INFO/NAME]       Select Daylight Saving Time
SYSLOG [1/2] [IP/OFF]     Set/delete Syslog server IP addresses
NETDEFAULT                Set default network configuration
SSH|TELNET|HTTP [ON/OFF] Enable/disable management servers
SSH PORT [N]              Set TCP or UDP port for selected service
RADIUS [1/2] SECRET       Set shared key for Radius Server 1 or 2
RADIUS [1/2] TEST         Test Radius server connection and User data
RADIUS [1/2] [IP:PORT/OFF]Set/delete IP address and port for Radius Server
RADIUS RETRIES [0..10]    Set number of retries for both Radius servers
RADIUS TIMEOUT [1..5]     Set Radius response timeout, seconds
SYSNAME [SET]             Show/Set sysName variable
SYSLOCATION [SET]         Show/Set sysLocation variable
SYSCONTACT [SET]          Show/Set sysContact variable
STATUS RADIUS [NRSB]      Show RADIUS server status and parameters
APPLY [ALL/GROUP]         Apply changes to running configuration
CONNECT [N:[1-13/R]]      Establish connection to remote unit
LINK [NN]                 Establish local connection
LINKCLEAR                 Exit all local connections
M                         Return to Configuration Management Menu
H                         Show available commands
--------------------------------------------------------------------------------
CP_NET>
```

5.7.5.40 <NETCONFIG [N/R/S/B]> Command

Without parameters the <NETCONFIG> command displays the running configuration of the network subsystem and interfaces:

```
CP_NET>NETCONFIG
--------------------------------------------------------------------------------

Running Network Configuration
--------------------------------------------------------------------------------

Ethernet settings : LAN1  LAN2  WAN1  WAN2   INT
  Description     : LAN1  LAN2  WAN1  WAN2   INT
  Access/Trunk    :  ACC   ACC  Trunk Trunk  ACC
  Port-based VLAN :  [A]   [A]   [A]   [A]  [A]
  VLAN            :   1     1                1
  QoS             :   2     2                2
  VLAN1 VID=1     :               +     +
  VLAN2 VID=2     :               +     +
  VLAN3 VID=3     :               +     +
  VLAN4 VID=4     :               +     +
  VLAN5 VID=5     :               +     +
  VLAN6 VID=6     :               +     +
  VLAN7 VID=7     :               +     +
  VLAN8 VID=8     :               +     +
  OTHER VLANS     :               +     +
  Speed           : AUTO  AUTO
  Flow control    :  OFF   OFF
System settings
  IP address      :  192.168.0.235    MAC address     :  00:0f:d9:12:36:0d
  Subnet mask     :  255.255.255.0    Management MTU  :  1500
  Default gateway :  192.168.0.254    WAN idle pattern:  All 1's
SNMP
  SNMP versions   :  v1 v2c v3
  Allowed pollers :  All
  Trap IP/version :  192.168.169.12(v3, RO)
SNMP v1,v2c community
  GET/SET/TRAP    :  public/public/public
  SET command     :  Enabled
SNMP v3 users     :  Read-only (RO)           Read-write (RW)
  Security name   :  snmp_ro                  snmp_rw
  Auth/Priv       :  none/none                not selected
  Auth Password   :  ---                      ---
  Priv Password   :  ---                      ---
Services          :  TELNET, SSH(22), HTTP
  Syslog servers  :
  SNTP   servers  :  192.168.1.254                                  TZ: UTC+01:00
  Summer time     :  MAR lastSUN  (30) 00:00w +60min
  Winter time     :  OCT lastSUN  (26) 00:00w +0min
  Radius servers  :  192.168.1.252:1812       192.168.1.254:1812
  Radius secret   :  entered                  entered
--------------------------------------------------------------------------------
CP_NET>
```

VLAN (VLANs & QoS) configurations	
Ethernet settings	Port identifier of the internal Ethernet switch
Description	Port Description (ifAlias)
Mode	Type of port (trunk, access or mixed)
Port based VLAN	Isolation of ports
VLAN	VLAN identifier for each of access ports
QoS	Priority for each of access ports
VLAN1 VID=xx : : VLAN8 VID=xx	Configurations and identifiers (xx=1..4094) for each of 8 VLANs which are configured separately. Pluses and minuses mark transmission/locking of VLAN for each of interfaces.
OTHER VLANS	Configurations for other VLANs, which are not configured separately. Pluses and minuses mark transmission/locking for each of interfaces.
Ethernet port configurations	

Speed/Duplex	Operation mode of the Ethernet interface
Flow control	Flow control mode of the Ethernet interface
General settings	
MAC address	MAC address of the device
IP address	IP address of the device
Subnet Mask	Network mask of the device
Default Gateway	Default gateway of the device
Management MTU	Maximal size of management packets, bytes
WAN idle pattern	Idle pattern for empty frames if transmitted over E1 links: all 1's or 7E
SNMP settings	
SNMP Version	Active SNMP versions
Allowed pollers	List of hosts allowed to perform SNMP poll
Trap IP/version	IP address of Trap receiver and Trap version. If SNMP v3 is selected, it is shown what user (RO or RW) will send trap messages.
GET/SET/TRAP	SNMP v1 and v2c community for GET, SET and TRAP messages
SET command	Enabled or Blocked SNMP V1 and V2c SET operation
SNMP v3 users	User with Read-Only (RO) and Read-Write (RW) access rights
Security name	User names for RO and RW user
Auth/Priv	User Authentication (MD5/SHA/NONE) and Privacy (DES/AES/NONE)
Auth password	Authentication password (SNMP v3)
Priv password	Privacy password (SNMP v3)
Service settings	
Services	List of running management servers
Syslog servers	First and Second Syslog server IP address
SNTP servers	First and Second SNTP server IP address
TZ	Time Zone settings
Summer Time	Summer Time change settings
Winter Time	Winter Time change settings
Radius servers	IP address and port used for first and second RADIUS servers
Radius secret	Shows if shared secret has been entered or not

The NETCONFIG command always displays the running configuration. If the new configuration differs from the running one, the NETCONFIG command displays the running configuration and a warning:

```
--------------------------------------------------------------------------------
Warning: New network configuration differs from running network configuration!
         To view new network configuration, type 'NETCONFIG N'
         To view running network configuration, type 'NETCONFIG R'
         To apply changes in configuration, type 'APPLY VLAN' or 'APPLY ALL'.
         Do not forget to 'CONFIRM' a good working configuration.
CP_NET>
```

The <NETCONFIG [N/R/S/B]> command displays one of four configurations: New, Running, Startup, or Backup, depending on the parameter.

After successful execution of a command that changes any parameter showed by NETCONFIG, the new configuration is shown. The warning message explaining that the new configuration differs from the running configuration is displayed as well .

5.7.5.41 <COSCONFIG [N/R/S/B]> Command

Without parameters the <COSCONFIG> command displays the running CoS configuration:

```
CO_NET>COSCONFIG
--------------------------------------------------------------------------------
```

```
Running QoS Configuration
--------------------------------------------------------------------------------

QoS to CoS mapping      Per-VLAN CoS override
--------------------    --------------------
QoS : 0 1 2 3 4 5 6 7   VLAN: 1 2 3 4 5 6 7 8
CoS : 3 3 3 3 3 3 3 3   CoS : - - - - - - - -

---------------Rate limit--------------------
Egress  :   WAN1   WAN2   WAN3   WAN4
CoS 0   :    OFF    OFF    OFF    OFF
CoS 1   :    OFF    OFF    OFF    OFF
CoS 2   :    OFF    OFF    OFF    OFF
CoS 3   :    OFF    OFF    OFF    OFF
-----------------------------------------
Ingress :   LAN1   LAN2
Per port:    OFF    OFF
Total   :    OFF
--------------------------------------------------------------------------------

CO_NET>
```

It shows the QoS-to-CoS and VLAN-to-CoS mapping. CoS (Class of Service) as well as QoS (Quality of Service) have to be configured for a correct behaviour!
The rate limits for any interface is showed too.

The <COSCONFIG [N/R/S/B]> command displays one of four CoS configurations: New, Running, Startup, or Backup, depending on the parameter.

5.7.5.42 <RSTP DEFAULT> Command

RSTP DEFAULT command restores factory settings for RSTP subsystems:

- All RSTP instances are disabled; modem works like it has no RSTP system.
- Each system interface has priority 128 (0x80)
- Each system interface calculates PCOST automatically
- Each RSTP instance has priority 32768 (0x8000)
- Each RSTP instance works in VLAN# 1
- Hello time for each RSTP instance is 2 seconds

```
CP_03_NET>RSTP DEFAULT
 PB Status   Vlan/VID Prio  Hello
----------------------------------
 A  Disabled 1/1      32768 2
 B  Disabled 1/1      32768 2
 C  Disabled 1/1      32768 2
 D  Disabled 1/1      32768 2
 E  Disabled 1/1      32768 2
----------------------------------
IFACE  Prio PathCost  Edge
--------------------------
LAN1   128  AUTO      Yes
LAN2   128  AUTO      Yes
LAN3   128  AUTO      Yes
LAN4   128  AUTO      Yes
LAN5   128  AUTO      Yes
WAN1   128  AUTO      Yes
WAN2   128  AUTO      Yes
WAN3   128  AUTO      Yes
WAN4   128  AUTO      Yes
MWAN1  128  AUTO      Yes
MWAN2  128  AUTO      Yes
--------------------------
CP_03_NET>
```

5.7.5.43 <RSTP [A..E] [ON/OFF]> Command

RSTP system creates separate instance for each PBVLAN. Every instance will work only with ports included in specific PBVLAN. It means that up to 5 RSTP instances could be created on a device.

RSTP [A . . E] [ON/OFF] Command enables/disables RSTP for specific PBVLAN.

5.7.5.44 <RSTP [A..E] PRIO [value]> Command

This command allows to setup custom bridge priority for RSTP instance working at specific PBVLAN. This value represents priority and settable part of bridge id (802.1D - 2004, 9.2.5). Smaller value denotes better priority. This option allows Root bridge selection for network and it's replacements in case of faults. Available interval is from 0 to 65535 inclusively. It is recommended to use values from 0 to 61440 while each value should be multiple of 4096.
Default RSTP bridge priority is 32768.

5.7.5.45 <RSTP [A..E] VLAN [1..8]> Command

This command allows selection of a VLAN that will be used for RSTP service data transmission (BPDU) for RSTP instance working at specific PBVLAN. Please note that RSTP will relay on network topology covered by selected VLAN, that’s why a VLAN that covers all network should be selected. Default VLAN is 1.

5.7.5.46 <RSTP [A..E] HELLO [2..10]> Command

This command selects time interval between two consecutive RSTP service messages in seconds. It means that BPDU packets will be send every HELLO time. Default value is 2 seconds.

5.7.5.47 <RSTP [IFACE] PRIO [0..240]> Command

This command selects interface priority. The value should be multiple by 16. The port priority intended to resolve situation when several interfaces have the same root path cost. The port with lowest port priority will be selected then. Available interfaces are:

- LAN1 – LAN5
- WAN 1, 2, 3, 4
- MWAN 1, 2

5.7.5.48 <RSTP [IFACE] PCOST [AUTO/1..200000000]> Command

This command allows automatic path cost selection or allows manual settings. In automatic mode the value depends on the bit rate. The higher bit rate the lower path cost is. The port with lower path cost will be selected as root port. Available interfaces are:

- LAN1 – LAN5
- WAN 1, 2, 3, 4
- MWAN 1, 2

5.7.5.49 <RSTP [IFACE] EDGE [ON/OFF]> Command

This command sets EDGE attribute of a selected interface. If EDGE is ON, the port will not forward RSTP BPDU packets in egress direction and will work in Designated state. Other packets will be forwarded. But if it will receive BPDU in ingress direction, it will switch its role to EDGE OFF and will fall into Forwarding or Blocked state depends on network topology. If EDGE

is manually set to OFF, it will newer become EDGE port, i.e. if BPDU packet will not be received after 30 seconds the port will fall into Blocked state. Available interfaces are:

- LAN1 – LAN5
- WAN 1, 2, 3, 4
- MWAN 1, 2

5.7.5.50 <RSTP CONF> Command

This command shows actual RSTP configuration for all instances.

```
CP_03_NET>RSTP CONF
 PB Status   Vlan/VID Prio  Hello
---------------------------------
 A  Enabled  1/1      32768 2
 B  Disabled 1/1      32768 2
 C  Disabled 1/1      32768 2
 D  Disabled 1/1      32768 2
 E  Disabled 1/1      32768 2
---------------------------------
IFACE  Prio PathCost  Edge
--------------------------
LAN1   128  AUTO      Yes
LAN2   128  AUTO      Yes
LAN3   128  AUTO      Yes
LAN4   128  AUTO      Yes
LAN5   128  AUTO      Yes
WAN1   128  AUTO      Yes
WAN2   128  AUTO      Yes
WAN3   128  AUTO      Yes
WAN4   128  AUTO      Yes
MWAN1  128  AUTO      Yes
MWAN2  128  AUTO      Yes
--------------------------
CP_03_NET>
```

RSTP configurations for whole device	
PB	Port Base VLAN letter. Could be from A to E
Status	RSTP status for an instance.
VLAN/VID	Displays service VLAN number and VID for RSTP service messages
Prio	RSTP bridge priority
Hello	Hello time in seconds
RSTP configuration for an interface	
IFACE	Interface name
Prio	Interface priority
PathCost	Interface Path Cost
Edge	Edge attribute is enabled or disabled

5.7.5.51 <RSTP STATE> Command

Command shows RSTP actual status.

```
CP_03_NET>RSTP STATE

 PV PortID IFACE Status State Role Bitrate   PCost          Edge
-------------------------------------------------------------------
 A  8001   LAN1  UP     Fwd   Desi 100.0Mbit AUTO/200000    Yes
    8002   LAN2  DOWN    ---   ---    ---     AUTO/   ---     ---
    8003   LAN3  DOWN    ---   ---    ---     AUTO/   ---     ---
    8004   LAN4  DOWN    ---   ---    ---     AUTO/   ---     ---
    8005   LAN5  DOWN    ---   ---    ---     AUTO/   ---     ---
    8006   WAN1  UP     Disc  Alt  5.696Mbit AUTO/3511235   No
    8007 R WAN2  UP     Fwd   Root 5.696Mbit AUTO/3511235   No
    8008   WAN3  DOWN    ---   ---    ---     AUTO/   ---     ---
    8009   WAN4  DOWN    ---   ---    ---     AUTO/   ---     ---
    800A   MWAN1 DOWN    ---   ---    ---     AUTO/   ---     ---
```

```
    800B   MWAN2 DOWN     ---    ---     ---     AUTO/    ---      ---
 B  8001   MWAN1 DOWN     ---    ---     ---     AUTO/    ---      ---
    8002   MWAN2 DOWN     ---    ---     ---     AUTO/    ---      ---
 C  8001   MWAN1 DOWN     ---    ---     ---     AUTO/    ---      ---
    8002   MWAN2 DOWN     ---    ---     ---     AUTO/    ---      ---
 D  8001   MWAN1 DOWN     ---    ---     ---     AUTO/    ---      ---
    8002   MWAN2 DOWN     ---    ---     ---     AUTO/    ---      ---
 E  8001   MWAN1 DOWN     ---    ---     ---     AUTO/    ---      ---
    8002   MWAN2 DOWN     ---    ---     ---     AUTO/    ---      ---
-------------------------------------------------------------------
CP_03_NET>
```

RSTP Status	
PV	Port Base VLAN letter
PortID	Port identification
IFACE	Interface name
Status	Status of a port: Up or Down
State	State of a port: Forwarding or Discarding
Role	Port role: Designating, Root or Alternative
Bitrate	Port bitrate
PCost	Actual interface Path Cost.
Edge	Edge status of a port.

5.7.5.52 <PBVLAN [IF] [A..E]> Command

This command assigns the network interface (LANx, WANx, INT) to one of 5 port-based VLANS (PBVLAN A..E).

```
CP_NET>PBVLAN LAN1 B
CP_NET>PBVLAN INT A
-------------------------------------------------------------------------------

New Network Configuration
-------------------------------------------------------------------------------

Ethernet settings : LAN1  LAN2  WAN1  WAN2  WAN3  WAN4   INT
  Access/Trunk    :  ACC   ACC  Trunk Trunk Trunk Trunk  ACC
  Port-based VLAN :  [B]   [A]   [A]   [A]   [A]   [A]   [A]
  VLAN            :   1     1                             1
  QoS             :   2     2                             2
  VLAN1 VID=1     :               +     +     +     +
  VLAN2 VID=2     :               +     +     +     +
  VLAN3 VID=3     :               +     +     +     +
  VLAN4 VID=4     :               +     +     +     +
  VLAN5 VID=5     :               +     +     +     +
  VLAN6 VID=6     :               +     +     +     +
  VLAN7 VID=7     :               +     +     +     +
  VLAN8 VID=8     :               +     +     +     +
  OTHER VLANS     :               +     +     +     +
  Speed           : AUTO  AUTO
System settings   :
  MAC address     :  00:0f:d9:04:a9:60
  IP address      :  192.168.0.253
  Subnet mask     :  255.255.255.0
  Default gateway :  192.168.0.254
SNMP:
  Send traps to IP:
  Community       :  public
  SET command     :  Enabled
-------------------------------------------------------------------------------

Warning: New network configuration is shown, because it differs from running.
         To view new network configuration, type 'NETCONFIG N'.
         To view running network configuration, type 'NETCONFIG R'.
         To apply changes in configuration, type 'APPLY VLAN' or 'APPLY ALL'.
         Do not forget to 'CONFIRM' a good working configuration.
CO_NET>
```

PBVLANs are used as a way to isolate groups of network interfaces from each other. No frames from interface LAN2 connected to PBVLAN A will ever be forwarded to interface INT, which is connected to PBVLAN E. And vice versa.
Each PBVLAN is a separate switching fabric. As there are 5 PBVLAN and no more than 10 network interfaces in the modem, one can connect any WAN interface to any LAN interface exclusively, as well as create isolated LAN-LAN or LAN-INT connections. Each PBVLAN can include from none to all interfaces. To populate PBVLAN with interfaces, just set the appropriate PBVLAN letter for selected interfaces.
PBVLAN isolation works only in the limits of one modem. Outside the modem, there is no information about the PBVLAN letter the frame had inside. This is the major difference with VLANs, where the VLAN information is carried in the VLAN tag. So, it does not hurt if WAN1, PBLAN A on one modem is connected to WAN1, PBVLAN C on another.
PBVLAN isolation also affects aggregation of WANs in MWAN (multi-WAN). Only WAN channels from the same PBVLAN will aggregate with each other. For example, if WAN1 and WAN3 are in PBVLAN A, and WAN2 and WAN4 are in PBVLAN B, and all WANs go in one direction, two MWANs will be created each consisting of 2 WANs instead of 1 MWAN with 4 WANs.
Creating a PBVLAN with only LAN ports and one WAN port will allow the modem to eliminate most software processing of frames, creating bridge connection and thus reducing frame propagation delay. The same applies to the case when there are several WAN ports in the PBVLAN, but they all go in the same direction. Assigning INT port to the PBVLAN with LAN and WAN will turn on the internal Layer2 switch. This will, however, not be sensible in most of the applications.
Most setups where LAN traffic separation is needed can be made with PBVLANs only or VLANs only. In some setups PBVLANs way has benefits, in some the VLAN way. Mix of VLANs and PBVLANs is also convenient in some applications. The user can select the approach.

5.7.5.53 <MODE [IF] [ACC/TRUNK/MIX]> Command

This command selects the 802.1Q VLAN mode for any LAN interface. Along with the full words ACCESS, TRUNK and MIXED, also abbreviations can be used, for example A or ACC for ACCESS, MIX or M for MIXED.

In ACCESS mode only untagged frames pass into (ingress) and out of (egress) the LANx port. On ingress, frames are assigned to default VLAN tag with VID and QoS defined by QOS, VLAN and VID commands. On egress, only frames with VLAN equal to the default VLAN of the port (set with VLAN command) are allowed, and the VLAN tag is removed.
In TRUNK mode only tagged frames pass into and out of the LANx port. Frames are allowed to pass on per-VLAN basis. VLANs allowed to pass are those selected with the ALLOW command (any combination of VLAN1-8 and OTHER can be selected).
In MIXED mode tagged and untagged traffic is allowed on the port. However, on ingress, a default VLAN tag (selected with QOS, VLAN and VID commands) is added to untagged frames so that all frames in the system are actually tagged. On egress frames with VLAN equal to the default VLAN (set with VLAN command) exit the port untagged, while to all other VLANs apply pass/block rules are set by the ALLOW command.

5.7.5.54 <VLAN [IF] [1..8]> Command

This command sets default VLAN number for interfaces in ACCESS or MIXED mode ([IF] is LANx, INT). Default VLAN is used to assign VLAN information for untagged traffic.

In ACCESS mode, only frames with VLAN equal to port's default VLAN are allowed to egress.
In MIXED mode, frames with VLAN equal to port's default VLAN egress untagged. Frames of al other VLANs are blocked or are allowed to egress tagged according to rules set by ALLOW command.
In both ACCESS and MIXED modes ingressing untagged frames are assigned to default VLAN.

There are 8 separately managed VLANs in the modem. For each managed VLAN the VID (VLAN ID) can be selected with the VID command.

5.7.5.55 <QOS [IF] [0..7]> Command

This command sets default QoS for interfaces in ACCESS or MIXED mode ([IF] is LANx, INT). The Lowest priority is 0, the highest is 7. Default QoS is used to assign quality of service information for ingressing untagged traffic.
The INT interface is always considered in ACCESS mode and all frames coming from the INT interface will have default QoS assigned.

5.7.5.56 <ALLOW [IF] [VLAN list]> Command

This command selects which VLANs are allowed on interfaces in TRUNK or MIXED mode ([IF] is LANx, WANx).
The VLAN list is a comma-separated list of allowed VLANS from 1 to 8, and the word OTHER (allows all other VLANs except 1-8). Spaces in the list are not allowed. To allow all VLANS on the interface, write ALL in the list.

```
CP_NET>ALLOW LAN1 1,2,3
CP_NET>ALLOW WAN2 5,3,OTHER
CP_NET>ALLOW WAN4 ALL
```

5.7.5.57 <VID [1-8] ID> Command

The <VID [1...8] ID> command sets VID for the VLAN with the number 1..8 equal to the ID parameter. ID=1...4094. 8 VLANs are supported by the device, and available VID numbers assigned to the VLAN are in the range from 1 to 4094. VID as well as QoS are an attribute of the VLAN packet.

5.7.5.58 <MACLIST SHOW> Command

Without parameters the <MACLIST SHOW> command displays the whole MAC Filter table for all available interfaces:

```
CX_05_NET>MACLIST SHOW
------------------------------------------------------------------------------
Running MAC Filter Configuration
------------------------------------------------------------------------------
Port     LAN1           LAN2           LAN3           LAN4           LAN5
Mode   ON/FILTER     ON/INDICATE     ON/BLOCK       ON/BLOCK      OFF/FILTER
White list
  1  0090f5-3e7a0b  0090f5-bb7a0b  0090f5-bb7a0b  0090f5-bb7a0b       ---
  2  0090f5-bb7a0b  0090cc-3e7a0b  0090cc-3e7a0b  0090cc-3e7a0b       ---
  3  0090cc-3e7a0b       ---            ---            ---            ---
  4       ---            ---            ---            ---            ---
  5       ---            ---            ---            ---            ---
  6       ---            ---            ---            ---            ---
  7       ---            ---            ---            ---            ---
  8       ---            ---            ---            ---            ---
  9       ---            ---            ---            ---            ---
 10       ---            ---            ---            ---            ---
------------------------------------------------------------------------------
```

MAC Filter configuration	
Port	Port identifier of the internal Ethernet switch
Mode	ON: MACFILTER is enabled OFF: MACFILTER is disabled FILTER: non-listed ingress packets will be filtered INDICATE: non-listed ingress packets will be filtered and SNMP Trap will be generated

	BLOCK: port will be blocked upon receiving of non-listed packet and SNMP Trap will be generated
White list	List of allowed MAC addresses per interface

The <MACLIST SHOW [N/R/S/B]> command displays, depending on the parameter, one of four configurations: New, Running, Startup, or Backup.

5.7.5.59 <MACLIST [IF] ADD [MAC]> Command

The <MACLIST [IF] ADD [MAC]> command adds [MAC] address to the White List of the specified [IF] interface:

```
CX_05_NET>MACLIST 1 ADD 00-90-F5-3E-7F-AC
------------------------------------------------------------------------------
New  MAC Filter Configuration
------------------------------------------------------------------------------
Port     LAN1           LAN2           LAN3           LAN4           LAN5
Mode   ON/FILTER     ON/INDICATE     ON/BLOCK       ON/BLOCK      OFF/FILTER
White list
  1  0090f5-3e7a0b  0090f5-bb7a0b  0090f5-bb7a0b  0090f5-bb7a0b       ---
  2  0090f5-bb7a0b  0090cc-3e7a0b  0090cc-3e7a0b  0090cc-3e7a0b       ---
  3  0090cc-3e7a0b       ---            ---            ---            ---
  4  0090f5-3e7fac       ---            ---            ---            ---
  5       ---            ---            ---            ---            ---
  6       ---            ---            ---            ---            ---
  7       ---            ---            ---            ---            ---
  8       ---            ---            ---            ---            ---
  9       ---            ---            ---            ---            ---
 10       ---            ---            ---            ---            ---
------------------------------------------------------------------------------
```

It is allowed to use interface number or interface name, for example LAN1 as [IF] parameter. System accepts ":" or "-" symbols as MAC address separator. It is possible to enter MAC address without separator at all.

5.7.5.60 <MACLIST [IF] DEL [MAC/N]> Command

The < MACLIST [IF] DEL [MAC/N]> command deletes [MAC] address or entry number [N] from the White List of [IF] interface:

```
CX_05_NET>MACLIST LAN1 DEL 5
------------------------------------------------------------------------------
New  MAC Filter Configuration
------------------------------------------------------------------------------
Port     LAN1           LAN2           LAN3           LAN4           LAN5
Mode   ON/FILTER     ON/INDICATE     ON/BLOCK       ON/BLOCK      OFF/FILTER
White list
  1  0090f5-3e7a0b  0090f5-bb7a0b  0090f5-bb7a0b  0090f5-bb7a0b       ---
  2  0090f5-bb7a0b  0090cc-3e7a0b  0090cc-3e7a0b  0090cc-3e7a0b       ---
  3  0090cc-3e7a0b       ---            ---            ---            ---
  4  0090f5-3e7fac       ---            ---            ---            ---
  5       ---            ---            ---            ---            ---
  6       ---            ---            ---            ---            ---
  7       ---            ---            ---            ---            ---
  8       ---            ---            ---            ---            ---
  9       ---            ---            ---            ---            ---
 10       ---            ---            ---            ---            ---
------------------------------------------------------------------------------
```

It is allowed to use interface number or interface name, for example LAN1 as [IF] parameter. System accepts ":" or "-" symbols as MAC address separator. It is possible to enter MAC address without separator at all.

5.7.5.61 <MACFILTER [LAN1-5] [ON/OFF]> Command

The <MACFILTER [LAN1-5] [ON/OFF]> command enables or disables MAC Filter option on selected LAN interface.

```
CX_05_NET>MACFILTER 4 OFF
-------------------------------------------------------------------------------
New  MAC Filter Configuration
-------------------------------------------------------------------------------
Port     LAN1           LAN2           LAN3           LAN4           LAN5
Mode   ON/FILTER     ON/INDICATE     ON/BLOCK       OFF/BLOCK     OFF/FILTER
White list
  1  0090f5-3e7a0b  0090f5-bb7a0b  0090f5-bb7a0b  0090f5-bb7a0b       ---
  2  0090f5-bb7a0b  0090cc-3e7a0b  0090cc-3e7a0b  0090cc-3e7a0b       ---
  3  0090cc-3e7a0b       ---            ---            ---            ---
  4  0090f5-3e7fac       ---            ---            ---            ---
  5       ---            ---            ---            ---            ---
  6       ---            ---            ---            ---            ---
  7       ---            ---            ---            ---            ---
  8       ---            ---            ---            ---            ---
  9       ---            ---            ---            ---            ---
 10       ---            ---            ---            ---            ---
-------------------------------------------------------------------------------
```

It is allowed to use interface number or interface name, for example LAN1 as [IF] parameter.

5.7.5.62 <MACRULE [LAN1-5] [RULE]> Command

The <MACRULE [LAN1-5] [rule]> command changes MAC Filter [RULE] for selected interface:

```
CX_05_NET>MACRULE 4 INDICATE
-------------------------------------------------------------------------------
New  MAC Filter Configuration
-------------------------------------------------------------------------------
Port     LAN1           LAN2           LAN3           LAN4           LAN5
Mode   ON/FILTER     ON/INDICATE     ON/BLOCK     OFF/INDICATE    OFF/FILTER
White list
  1  0090f5-3e7a0b  0090f5-bb7a0b  0090f5-bb7a0b  0090f5-bb7a0b       ---
  2  0090f5-bb7a0b  0090cc-3e7a0b  0090cc-3e7a0b  0090cc-3e7a0b       ---
  3  0090cc-3e7a0b       ---            ---            ---            ---
  4  0090f5-3e7fac       ---            ---            ---            ---
  5       ---            ---            ---            ---            ---
  6       ---            ---            ---            ---            ---
  7       ---            ---            ---            ---            ---
  8       ---            ---            ---            ---            ---
  9       ---            ---            ---            ---            ---
 10       ---            ---            ---            ---            ---
-------------------------------------------------------------------------------
```

It is allowed to use interface number or interface name, for example LAN1 as [IF] parameter.

MACRULE parameter	
Parameter	Description
FILTER	Default rule. Unlisted MAC will be filtered.
INDICATE	Equal to Filter Rule, but the SNMP message will be generated. Extended Traps must be activated.
BLOCK	If unlisted MAC will arrive the Port will be blocked and the SNMP message will be generated. Type ETHSD 10H/10F/100H/100F/AUTO X to restore port back.

5.7.5.63 <SETIP X.X.X.X> Command

The <SETIP A.B.C.D> command sets the IP-address of the modem. The parameter A, B, C and D can take values from 0 to 255 (note that neither address of the network nor the address of the node can be equal to 0, or to 255).

5.7.5.64 <NETMASK X.X.X.X> Command

The <NETMASK A.B.C.D> command sets the subnet mask of the modem.

5.7.5.65 <GATEWAY X.X.X.X> Command

The <GATEWAY X.X.X.X> sets the default IP address of the router.

5.7.5.66 <MTU> Command

This command sets the MTU size (Maximum Transmission Unit) for the port INT and is used just for management. Standard is 1500. For all other interfaces MTU is 2048.

5.7.5.67 <WANIDLE [1/7E]> Command

This command sets the idle pattern for a WAN interface. Sometimes, when the unit transmits Ethernet over E1, then an idle pattern of 1 is not convenient because the some E1 equipment will detect a Loss of Signal. In this case, the change of the idle pattern to 7E can help.

5.7.5.68 <ETHSD [10H/10F/100H/100F/AUTO/OFF] [N=1..2]> Command

The <ETHSD [10H/10F/100H/100F/AUTO/OFF] [N=1..2]> command sets the operating mode of the Ethernet port, where N is the number of the Ethernet port, 10/100 is the rate of 10 or 100 Mbit/s, F is full duplex and H is half duplex.

The <ETHSD AUTO> command activates the rate and duplex auto detection.

```
CO_CM>ETHSD 10H 1
CO_CM>ETHSD AUTO 2
```

5.7.5.69 <FC [ON/OFF] [N1-4]> Command

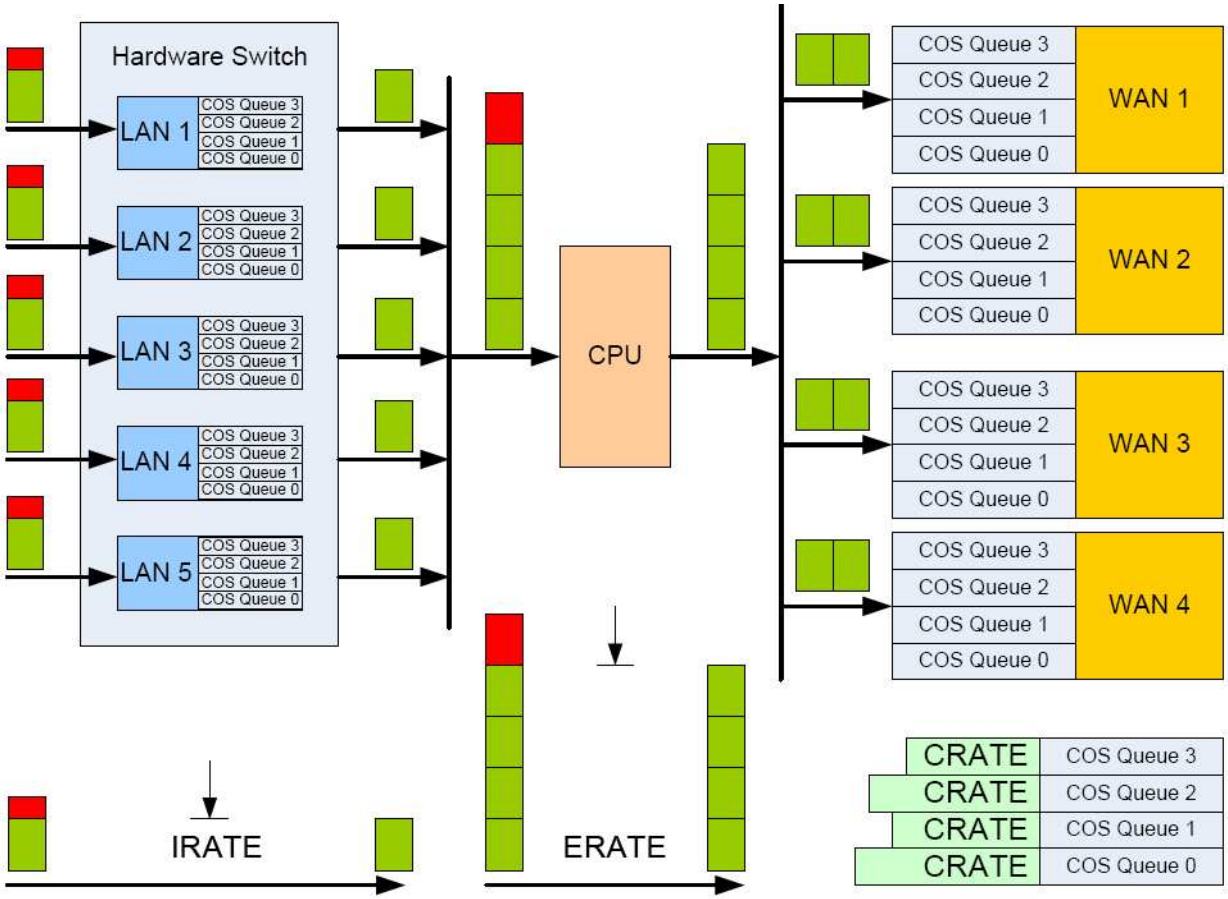
This command enables and disables IEEE 802.3x flow control on LAN ports.

5.7.5.70 <IRATE [speed/OFF] [N1-4]> Command

The command IRATE is an abridgement of the Ingress Rate. It limits the incoming data stream that reaches the internal Hardware Ethernet Switch. The IRATE can be set up for every LAN port separately.
IRATE command counts all arriving traffic without discrimination between ingress VLAN numbers and QoS settings. It means that IRATE command should be used when the LAN port is set to ACCESS mode, so all traffic will be processed by the internal switch with selectable VLAN and QoS settings. If incoming traffic has bigger bandwidth then selected by IRATE command, the excess will be dropped if Flow Control is disabled on the port, or the switch will send so called “MAC Pause Frame” if the Flow Control is enabled.
In general it is possible to use IRATE command if LAN port is set to TRUNK or to MIXED mode. IRATE command will limit the whole incoming bandwidth without taking into account VLAN tags and priorities inside incoming traffic. In that case a network will work without QoS support but with bandwidth control.

- IRATE [rate] [N]: Sets the desired rate limit.
- IRATE OFF [N]: Disable rate limiting.

The parameter [rate] is expressed in kbits or Mbits, for example:
128 means 128 kbps
256k means 256 kbps
1M means 1000kbps



5.7.5.71 <ERATE [speed/OFF]> Command

The command ERATE is an abridgement of Egress Rate. It limits the traffic heading to CPU of the device.
ERATE command counts all traffic, but unlike IRATE command the QoS settings make sense for traffic drop. In case if traffic has bigger bandwidth then the ERATE settings the device will drop traffic starting from packets with low priority tag.
Network administrator can configure QoS with IRATE and ERATE commands if LAN ports of the device works in ACCESS mode. He has to be sure that those LAN ports of the device have different default QoS or VLAN settings.

- ERATE [rate]: Sets the desired rate limit.
- ERATE OFF: Disable rate limiting.

The parameter [rate] is expressed in kbits or Mbits, for example:
30M means 30000kbps

5.7.5.72 <CRATE [speed] [CoS] [WAN]> Command

The command CRATE is an abridgement of CoS Rate. It limits the egress bandwidth of selected CoS queue for specified WAN interface. Starting from the 1.3.0 firmware FlexDSL Orion3 and MiniFlex devices have 4 CoS queues with numbers from 0 to 3. The queue with “0” number has the lowest priority while the queue with “3” number has highest priority. Command CRATE is not intended to define QoS [0…7] to CoS; or VLAN ID to CoS mapping. On the contrary, it is designed for assigning bandwidth each CoS queue can occupy.
Only CRATE command can be used if incoming traffic has VLANs, IRATE command is useless because the hardware Ethernet switch can’t check the QoS filed on its entry point. CRATE can

be used too if the traffic is not intended for LAN interface, for example repeater applications or interface converter mode when traffic is transmitted between two or several WAN interfaces.
If the sum of all CRATE settings and their load is bigger than the working bandwidth of WAN or MWAN interfaces, queues with high priority will be served firstly, while other queues will be hold in buffer and will wait for an opportunity to be transmitted.

- CRATE [rate] [CoS:0..3] [WAN:1..4]: Sets the desired rate limit.
- CRATE OFF [CoS:0..3] [WAN:1..4]: Disable rate limiting.

Examples: CRATE 128 2 1 – Sets rate limit to 128kbps for CoS2 on WAN1.

5.7.5.73 <COS [QOS/VLAN] [N] [0..3/OFF]> Command

This command sets the VLAN to CoS and QoS to CoS mapping.

COS [VLAN/QOS] [V=1..8/Q=0..7] [CoS=0..3/OFF]
VLAN: Change VLAN-to-CoS mapping
QOS: Change QoS-to-CoS mapping
V: VLAN number (1..8) according to NETCONFIG table
Q: IEEE 802.1p QoS (0..7)
CoS: Resulting CoS (0..3)
OFF: Turns off VLAN-to-CoS mapping for selected VLAN.

Examples: COS VLAN 1 3 - All frames in VLAN 1 will have CoS 3.

5.7.5.74 <SNMPACL> Command

This command is used to create SNMP ACL. If enabled, the SNMP SET and Poll messages will be accepted only from IP addresses inside this list.

SNMPACL [1/2] x.x.x.x - set 1st or 2nd IP address in x.x.x.x format.
SNMPACL [1/2] OFF - remove 1st or 2nd IP address.

5.7.5.75 <SNMP [V1|V2C|V3] [ON|OFF]> Command

This command activates or deactivates various SNMP versions.
<SNMP V3 ON>. This command enables SNMP v3.
<SNMP V1 OFF>. This command disables SNMP v1.

5.7.5.76 <TRAPIP [1/2] [IP/OFF]> Command

Command specifies one or two IP addresses to send SNMP traps to.

<TRAPIP 1 192.168.1.1>. This command set IP 192.168.1.1 as Trap Receiver 1
<TRAPIP 2 192.168.1.2>. This command set IP 192.168.1.2 as Trap Receiver 2
<TRAPIP 2 OFF>. This command removes 2-nd IP from Trap receivers list.

5.7.5.77 <TRAP [1/2] [V1/V2C]> Command

This command defines SNMP version of Trap messages for 1-s or 2-nd Trap receiver.

<TRAP 1 V1>. This command set SNMP version to v1 for 1-st Trap receiver.
<TRAP 2 V2C>. This command set SNMP version to V2c for 2-nd Trap receiver.

5.7.5.78 <TRAP [1/2] V3 [RO/RW]> Command

This command activates SNMP v3 for 1-st or 2-nd Trap receiver and assign the SNMP user (RO or RW) from whom the Trap messages will be send.

<TRAP 1 V3 RO>. This command assign RO SNMP user as "author" of Trap messages headed to 1-st Trap receiver.
<TRAP 2 V3 RW>. This command assign RW SNMP user as "author" of Trap messages headed to 2-nd Trap receiver.

5.7.5.79 <COMMUNITY> Command

This command allows changing of SNMP community for SET/GET/TRAP messages.

COMMUNITY [GET/SET/TRAP] - set GET, SET or TRAP community.
COMMUNITY - set all 3 community strings to the same value.

5.7.5.80 <SNMPSET [ON/OFF]> Command

The <SNMPSET ON> command enables processing SNMP SET requests, which allow to configure and manage the device, however, this command makes the device sensitive to attacks over SNMP in unprotected PC networks.
The <SNMPSET OFF> command disables processing SNMP SET requests, what protects the device from network attacks, but does not allow to configure and manage it.
Use this command to process SNMP SET requests only in protected networks. If the network is not protected, use this command during configuration and administration only.

5.7.5.81 <SNMP [RO|RW] NAME> Command

This command set SNMPv3 user name for user with Read-Only (RO) or Read-Write (RW) access rights.

<SNMP RO NAME>. This command set SNMP user with Read-Only access rights.
<SNMP RW NAME>. This command set SNMP user with Read-Write access rights.

5.7.5.82 <SNMP [RO|RW] AUTH [MODE]> Command

This command set SNMPv3 user authentication type for RO or RW user. The following authentication types are supported: MD5,SHA,NONE.

<SNMP RO AUTH SHA>. This command set SHA authentication type for SNMP user with Read-Only access rights.
<SNMP RW AUTH MD5>. This command set MD5 authentication type for SNMP user with Read-Write access rights.
<SNMP RO AUTH NONE>. This command disables authentication for SNMP user with Read-Only access rights.

5.7.5.83 <SNMP [RO|RW] PRIV [MODE]> Command

This command set SNMPv3 user encryption type for RO or RW user. The following encryption types are supported: DES,AES,NONE.

<SNMP RO PRIV DES>. This command set DES encryption type for SNMP user with Read-Only access rights.
<SNMP RW PRIV AES>. This command set AES encryption type for SNMP user with Read-Write access rights.
<SNMP RO PRIV NONE>. This command disables encryption for SNMP user with Read-Only access rights.

5.7.5.84 <SYSLOG [1/2] [IP/OFF]> Command

There is a build-in system Log (SYSLOG) client according to Syslog protocol (RFC-3164). It sends every message in a single UDP packet to the Syslog server. Message includes:

- Alarm status
- User login
- User actions

It is possible to add up to 2 Syslog severs. The SYSLOG command is used for that purpose.

SYSLOG [1/2] x.x.x.x - set 1st or 2nd IP address in x.x.x.x format.
SYSLOG [1/2] OFF - remove 1st or 2nd IP address.

5.7.5.85 <SNTP [1/2] [IP/OFF]> Command

The Syslog protocol should carry the real time stamp in every message. For this reason the SNTP protocol (RFC-2030) has been implemented. The SNTP protocol uses a part of NTP protocol features and it is compatible with SNTP or NTP servers. As soon as SNTP servers were added, the SNTP client tries to connect with the server every 10 seconds. After successful connection, the polling interval will become 1024 seconds

It is possible to add up to 2 SNTP servers. The SNTP command is used for that purpose.

SNTP [1/2] x.x.x.x - set 1st or 2nd IP address in x.x.x.x format.
SNTP [1/2] OFF - remove 1st or 2nd IP address

5.7.5.86 <SNTP TZ [+/-]HH:MM> Command

The SNTP servers provide UTC time. To change time zone use SNTP TZ command. Note that SNTP protocol doesn't check the summer/winter time offset.

SNTP TZ +4:00 - Set Moscow time
SNTP TZ +1:00 - Set CET (Central European time)
SNTP TZ -8:00 - Set PST (Pacific Standard time)

5.7.5.87 <DST> Command

This command configures Daylight Saving Time (DST) adjustable rules.

<DST [OFF/INFO/NAME]> Command

Parameter	Description
OFF	Disables Daylight Saving Time
INFO	List pre-defined time change rules
NAME	Select pre-defined time change rules

Pre-defined time change rules are:

Name	Rules	Description
Canada	MAR SUN>=8 (9) 02:00w +60min NOV firstSUN (2) 02:00w +0min	
Brazil	OCT SUN>=15 (19) 00:00w +60min FEB SUN>=15 (16) 00:00w +0min	
WS	SEP lastSUN (28) 03:00w +60min APR firstSUN (6) 04:00w +0min	Western Samoa
Syria	MAR lastFRI (28) 00:00w +60min OCT lastFRI (31) 00:00w +0min	
Palestine	MAR lastTHU (27) 24:00w +60min	

	SEP FRI>=21 (26) 00:00w +0min	
Azer	MAR lastSUN (30) 04:00w +60min OCT lastSUN (26) 05:00w +0min	Azerbaijan
C-Eur	MAR lastSUN (30) 02:00s +60min OCT lastSUN (26) 02:00s +0min	Central Europe
ChileAQ	SEP SUN>=2 (7) 04:00u +60min APR SUN>=23 (27) 03:00u +0min	Chile Antarctic
Iran	MAR 22 00:00w +60min SEP 22 00:00w +0min	
Paraguay	OCT firstSUN (5) 00:00w +60min MAR SUN>=22 (23) 00:00w +0min	
Cuba	MAR SUN>=8 (9) 00:00s +60min NOV firstSUN (2) 00:00s +0min	
E-Eurasia	MAR lastSUN (30) 00:00w +60min OCT lastSUN (26) 00:00w +0min	Eastern EurAsia
LH	OCT firstSUN (5) 02:00w +30min APR firstSUN (6) 02:00w +0min	Lord Howe Island
W-Eur	MAR lastSUN (30) 01:00s +60min OCT lastSUN (26) 01:00s +0min	Western Europe
NZ	SEP lastSUN (28) 02:00s +60min APR firstSUN (6) 02:00s +0min	New Zeland
Jordan	MAR lastTHU (27) 24:00w +60min OCT lastFRI (31) 00:00s +0min	
Chile	SEP SUN>=2 (7) 04:00u +60min APR SUN>=23 (27) 03:00u +0min	
Haiti	MAR SUN>=8 (9) 02:00w +60min NOV firstSUN (2) 02:00w +0min	
Chatham	SEP lastSUN (28) 02:45s +60min APR firstSUN (6) 02:45s +0min	
TC	MAR SUN>=8 (9) 02:00w +60min NOV firstSUN (2) 02:00w +0min	Turks and Caicos
Thule	MAR SUN>=8 (9) 02:00w +60min NOV firstSUN (2) 02:00w +0min	
Name	**Rules**	**Description**
RussiaAsia	MAR lastSUN (30) 02:00s +60min OCT lastSUN (26) 02:00s +0min	
AN	OCT firstSUN (5) 02:00s +60min APR firstSUN (6) 02:00s +0min	New South Wales
Morocco	MAR lastSUN (30) 02:00w +60min OCT lastSUN (26) 03:00w +0min	
AS	OCT firstSUN (5) 02:00s +60min APR firstSUN (6) 02:00s +0min	South Australia
Namibia	SEP firstSUN (7) 02:00w +60min APR firstSUN (6) 02:00w +0min	
AT	OCT firstSUN (5) 02:00s +60min APR firstSUN (6) 02:00s +0min	Tasmania
AV	OCT firstSUN (5) 02:00s +60min APR firstSUN (6) 02:00s +0min	State Victoria
EU	MAR lastSUN (30) 01:00u +60min OCT lastSUN (26) 01:00u +0min	European Union
Zion	MAR FRI>=23 (28) 02:00w +60min OCT lastSUN (26) 02:00w +0min	
E-Eur	MAR lastSUN (30) 00:00w +60min	Eastern Europe

	OCT lastSUN (26) 00:00w +0min	
NZAQ	SEP lastSUN (28) 02:00s +60min APR firstSUN (6) 02:00s +0min	New Zeland Antarctic
Mexico	APR firstSUN (6) 02:00w +60min OCT lastSUN (26) 02:00w +0min	
Uruguay	OCT firstSUN (5) 02:00w +60min MAR SUN>=8 (9) 02:00w +0min	
US	MAR SUN>=8 (9) 02:00w +60min NOV firstSUN (2) 02:00w +0min	United States
Fiji	OCT SUN>=21 (26) 02:00w +60min JAN SUN>=18 (19) 03:00w +0min	
EUAsia	MAR lastSUN (30) 01:00u +60min OCT lastSUN (26) 01:00u +0min	Nicosia

<DST [WINTER/SUMMER]> Command allows manually definition for winter and summer daylight saving time change. The following parameters must be entered in the dialog:

Parameter	Description
MONTH	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
DAY	Day when you change time. NN Particular month day number like 5 or 30 firstDDD First week day in the month with name DDD. DDD is three-letter abbreviation of day name: MON TUE WED THU FRI SAT SUN lastDDD Last week day in the month with name DDD. DDD>=NN A week day DDD when month day number is >= than NN.
TIME	A moment to adjust clock. Has format HH:MM[W|S|U] HH Hour MM Minutes [W|S|U] Defines Type of specified time (W if omitted) W Time change happens according your wall clock, taking in account time zone offset and current season time. S Time change happens according with Standard time, taking in account only time zone offset. U UTC time. Time change happens when UTC clock shows specified time.
OFFSET	Amount of time we add to Standard zone time when switch to specified season time. Format is either HH:MM or MM. Typical values are: 0 Local time will be UTC time + TZ offset(selected with SNTP TZ command) + 0 This is so called Standard time. 1:00 Local time will be UTC time + TZ offset + 01:00 60 Same as above (60 minutes == 01:00) In the summer time it is usually 60 and in the winter it's 0 min.

Example:

```
CO_06_NET>DST SUMMER
Month [MAR] : MAY
Day [lastSUN] : FIRSTMON
Time to advance the clock [00:00] : 02:00
Offset (relative to Standard zone time) [60 min] : 1:00
```

5.7.5.88 <[SSH|TELNET|HTTP] [ON/OFF]>

Command allows enabling or disabling of defined service.

```
CO_04_NET> SSH ON
--------------------------------------------------------------------------------
Running Network Configuration

<----------------------------------- cut ----------------------------------->

Service settings  :
  Running/Port    : TELNET, SSH(22), HTTP
  Syslog servers  : 255.255.255.255   255.255.255.255
  SNTP   servers  : 255.255.255.255   255.255.255.255
  RADIUS servers  : 255.255.255.255:1812     255.255.255.255:1812
  RADIUS secret   : entered                  entered
--------------------------------------------------------------------------------
CO_04_NET> TELNET OFF
--------------------------------------------------------------------------------
Running Network Configuration

<----------------------------------- cut ----------------------------------->

Service settings  :
  Running/Port    : SSH(22), HTTP
  Syslog servers  : 255.255.255.255   255.255.255.255
  SNTP   servers  : 255.255.255.255   255.255.255.255
  RADIUS servers  : 255.255.255.255:1812     255.255.255.255:1812
  RADIUS secret   : entered                  entered
--------------------------------------------------------------------------------
CO_04_NET>
```

Note: Default running management servers are TELNET and HTTP

5.7.5.89 <SSH PORT [N]>

Command changes port, the SSH server listens for incoming connections.

```
CO_04_NET> SSH PORT 2022
--------------------------------------------------------------------------------
Running Network Configuration

<----------------------------------- cut ----------------------------------->

Service settings  :
  Running/Port    : TELNET, SSH(2022), HTTP
  Syslog servers  : 255.255.255.255   255.255.255.255
  SNTP   servers  : 255.255.255.255   255.255.255.255
  RADIUS servers  : 255.255.255.255:1812     255.255.255.255:1812
  RADIUS secret   : entered                  entered
--------------------------------------------------------------------------------
CO_04_NET>
```

5.7.5.90 <RADIUS [1/2] SECRET>

Command defines common sharing secret for RADIUS server and client

```
CO_04_NET> RADIUS 1 SECRET
Enter  shared secret:
Repeat shared secret:
--------------------------------------------------------------------------------
Running Network Configuration

<----------------------------------- cut ----------------------------------->

Service settings  :
  Running/Port    : TELNET, SSH(22), HTTP
  Syslog servers  : 255.255.255.255         255.255.255.255
  SNTP   servers  : 255.255.255.255         255.255.255.255
  RADIUS servers  : 192.168.1.1:1812        255.255.255.255:1812
  RADIUS secret   : entered
--------------------------------------------------------------------------------
```

```
CO_04_NET>
```

5.7.5.91 <RADIUS [1/2] TEST>

The command test connection with defined RADIUS server and returns access rights or Non-authorised for selected user.

```
CO_FMM>RADIUS 1 TEST
Login: ORION3USER
Password:
Authorised; CONTROL+TEST+STATUS+CONFIG
CO_FMM>
```

5.7.5.92 <RADIUS [1/2] [IP:P/OFF]>

Command adds or removes the IP address of primary or secondary RADIUS server. It is possible to specify port, the client will try to connect to. If port is not defined the default UDP port 1812 will be used.

```
CO_04_NET> RADIUS 1 192.168.1.1
-------------------------------------------------------------------------------
Running Network Configuration

<---------------------------------- cut ---------------------------------->

Service settings  :
  Running/Port    : TELNET, SSH(2022), HTTP
  Syslog servers  : 255.255.255.255   255.255.255.255
  SNTP   servers  : 255.255.255.255   255.255.255.255
  RADIUS servers  : 192.168.1.1:1812         255.255.255.255:1812
  RADIUS secret   : entered                   entered
-------------------------------------------------------------------------------
CO_04_NET>RADIUS 2 192.168.2.253:21812
-------------------------------------------------------------------------------
Running Network Configuration

<---------------------------------- cut ---------------------------------->

Service settings  :
  Running/Port    : TELNET, SSH(2022), HTTP
  Syslog servers  : 255.255.255.255   255.255.255.255
  SNTP   servers  : 255.255.255.255   255.255.255.255
  RADIUS servers  : 192.168.1.1:1812         192.168.1.2:21812
  RADIUS secret   : entered                   entered
-------------------------------------------------------------------------------
CO_04_NET>
```

5.7.5.93 <RADIUS RETRIES [0..10]>

Command defines the number of retries, the RADIUS client will try to authenticate at first and second RADIUS server. If the first RADIUS server fail to give a reply within a defined timeout, the client sends request to the second RADIUS server. The requests keep going until the number exceeds the number of retries, then the client will use local record for authentication. Default parameter is 2 retries.

```
CO_FMM>RADIUS RETRIES 5
-------------------------------------------------------------------------
Status                :       Server 1             Server 2
-------------------------------------------------------------------------
Status                :       Connected            Not connected
Server IP             :       255.255.255.255      255.255.255.255
Server port           :       1812                 1812
Shared key            :       entered              empty
Retries               : 5
Timeout, seconds      : 2
-------------------------------------------------------------------------
CO_FMM>
```

5.7.5.94 <RADIUS TIMEOUT [1..5]>

Command defines the timeout is seconds. If RADIUS server gives no answer within defined period, the RADIUS client initialises next attempt. Default parameter is 2 seconds.

Command defines the timeout is seconds. If RADIUS server gives no answer within defined period, the RADIUS client initialises next attempt. Default parameter is 2 seconds.

```
CO_FMM>RADIUS TIMEOUT 3
-------------------------------------------------------------------------
Status                :       Server 1             Server 2
-------------------------------------------------------------------------
Status                :       Connected            Not connected
Server IP             :       255.255.255.255      255.255.255.255
Server port           :       1812                 1812
Shared key            :       entered              empty
Retries               : 5
Timeout, seconds      : 3
-------------------------------------------------------------------------
CO_FMM>
```

5.7.5.95 <STATUS RADIUS [N/R/S/B]> Command

This command Show 1-st and 2-nd RADIUS server status and parameters.

```
CO_06_FMM>STATUS RADIUS
-----------------------------------------------------------------------------
Status              :     Server 1             Server 2
-----------------------------------------------------------------------------
Status              :     Not connected        Connected
Server IP           :     192.168.1.252        192.168.1.254
Server port         :     1812                 1812
Server key          :     entered              entered
Retries             : 2
Timeout,seconds     : 2
-----------------------------------------------------------------------------
CO_06_FMM>
```

Parameter	Description
Status	Status of 1-st and 2-nd RADIUS Server
Server IP	IP address of 1-st and 2-nd RADIUS Server
Server port	Port, a server is listening on
Server key	Shows if shared secret has been entered or not

The <STATUS RADIUS [N/R/S/B]> command displays one of four RADIUS Server Status: New, Running, Startup, or Backup, depending on the parameter.

5.7.5.96 <NETDEFAULT> Command

The <NETDEFAULT> command sets the following configuration The MAC address of the modems takes the manufacturer value. The default IP address, sub-network masks and gateway are not changed.

```
CO_NET>NETCONFIG
-----------------------------------------------------------------------------

Running Network Configuration
-----------------------------------------------------------------------------

Ethernet settings : LAN1  LAN2  WAN1  WAN2  WAN3  WAN4   INT
  Access/Trunk    :  ACC   ACC  Trunk Trunk Trunk Trunk  ACC
  Port-based VLAN :  [A]   [A]   [A]   [A]   [A]   [A]   [A]
  VLAN            :   1     1                             1
  QoS             :   2     2                             2
  VLAN1 VID=1     :               +     +     +     +
  VLAN2 VID=2     :               +     +     +     +
  VLAN3 VID=3     :               +     +     +     +
  VLAN4 VID=4     :               +     +     +     +
```

```
  VLAN5 VID=5     :               +     +     +     +
  VLAN6 VID=6     :               +     +     +     +
  VLAN7 VID=7     :               +     +     +     +
  VLAN8 VID=8     :               +     +     +     +
  OTHER VLANS     :               +     +     +     +
  Speed           : AUTO  AUTO
System settings   :
  MAC address     :  00:0f:d9:04:a9:60
  IP address      :  192.168.0.253
  Subnet mask     :  255.255.255.0
  Default gateway :  192.168.0.254
SNMP:
  Send traps to IP:
  Community       :  public
  SET command     :  Enabled
--------------------------------------------------------------------------------

CO_NET>
```

6 SOFTWARE DOWNLOAD MINIFLEX SWITCH

A MiniFlex Switch card supports an upgrade of FXOS Operation System. This could be done through FTP protocol. To download please make sure that FTP server is running and accessible from a MiniFlex switch and run a command under privileged mode:

```
download ftp os <A.B.C.D> <user> <pass> <filename>
```

Here “A.B.C.D” is an IP address of FTP server;

“user” is a username

“pass” is a password

“filename” is a name of OS upgrade

If you want to keep current configuration after software update please type `save configuration`

Please restart a switch for applying a downloaded OS image

7 SOFTWARE DOWNLOAD SHDSL, SERIAL, FOM & SWITCH LINE CARD OR DINRAIL

The SHDSL line card & DINrail supports downloading new/old software versions to get some additional features or to protect the device with a released only software version. The download of the software can be performed in following ways:

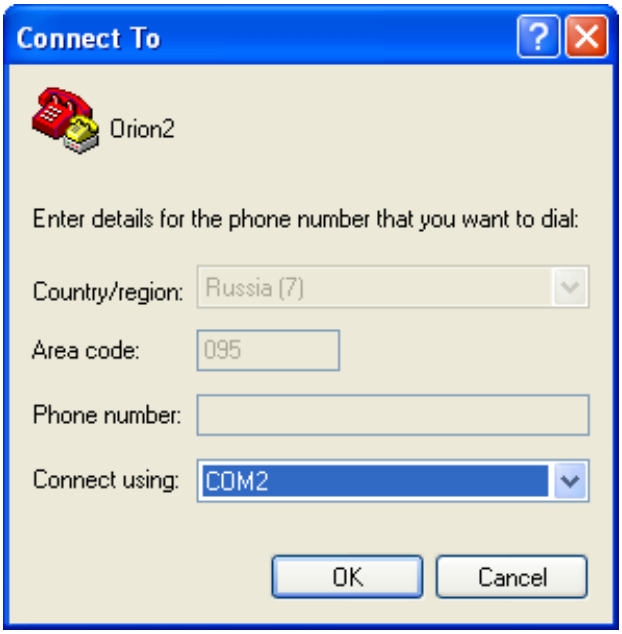
- via the USB port (LCT) by using the X-modem protocol
- via Ethernet (the X-modem protocol)

7.1 Software Download via USB Port (LCT) Using Xmodem Protocol

To download the software on any SHDSL line card & DINrail, do the following steps:

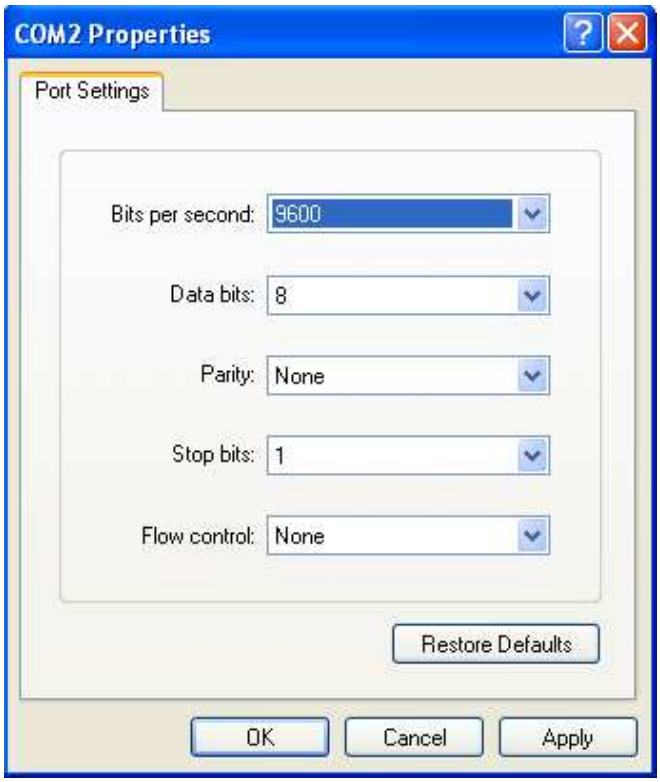
1. Power on the device.
2. Connect the USB connector of the device (LCT) with the USB cable of the Personal Computer.
3. Run the Hyper Terminal program (hypertrm.exe).
4. Create a new connection in the “Connection Description” window. Input the name of the connection in the “Name” field. Click “Ok”.

5. Then the “Connect To” window is displayed. Select the COM port connected to the SHDSL line card in the “Connect Using” drop-down menu.
   To use the USB interface as local craft terminal, you need to download and install the following driver http://www.flexdsl.ch/extranetfiles/Software/Orion3_USB_Driver.zip. This is an USB to serial driver and allow to have a COM port over USB.
   Click “Ok”.

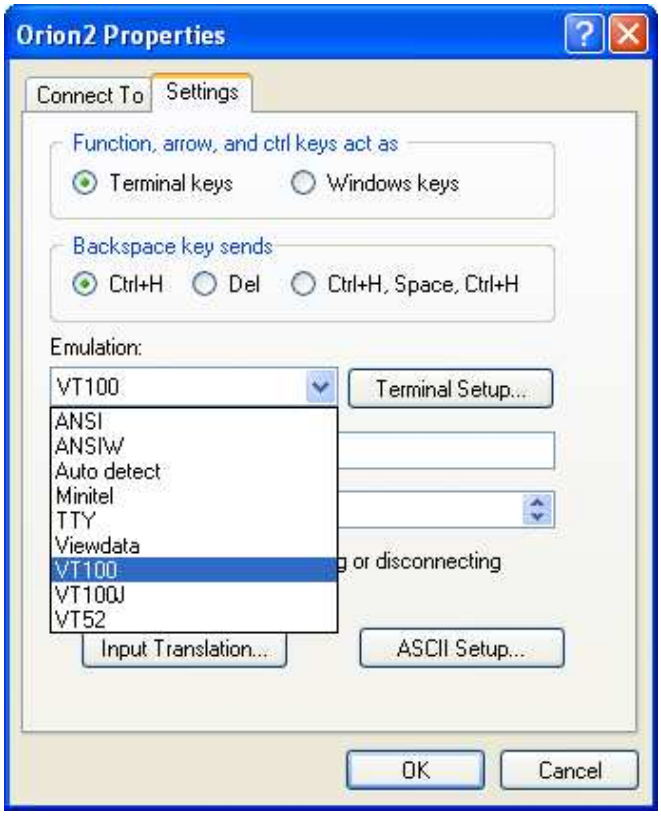


Configure the parameters of the COM port (COM properties). Click “Ok”.

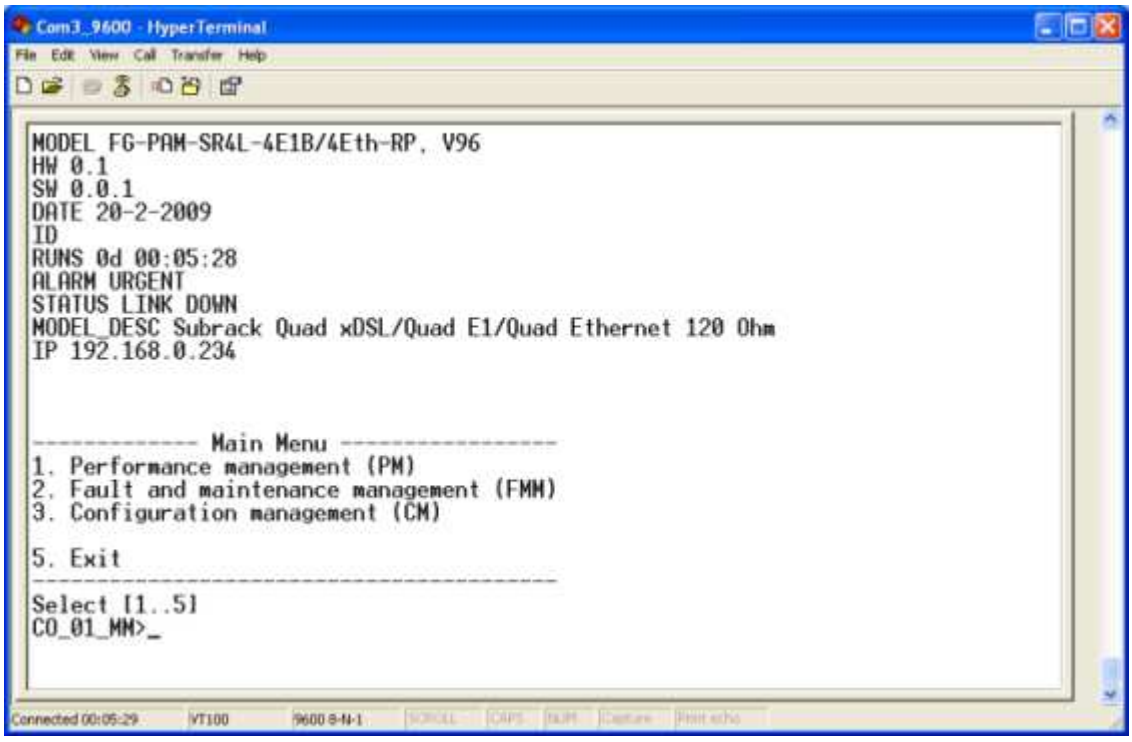
Bits per second:9600, Data bits: 8, Parity: None, Stop bits: 1, Flow control: None



6. Select Properties in the “File” menu of the HyperTerminal program.
7. Select the “Setting” tab. Select the VT100 emulation in the “Emulation” menu. Click “Ok”.



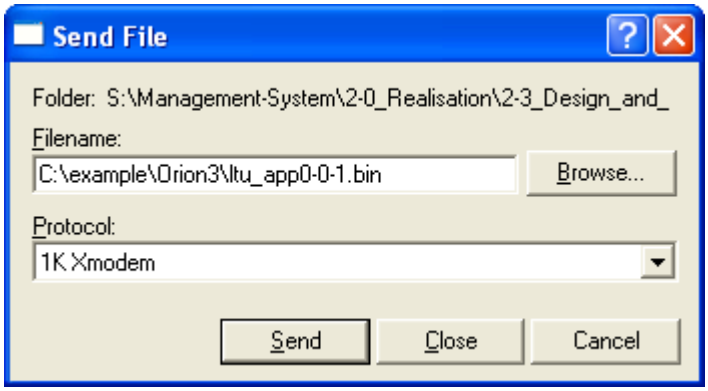
8. Select Call in the “Call” menu. (If the menu is not available, the connection is established automatically. Go to item 10.)
9. Press <Enter>. The main menu of the device will be displayed.



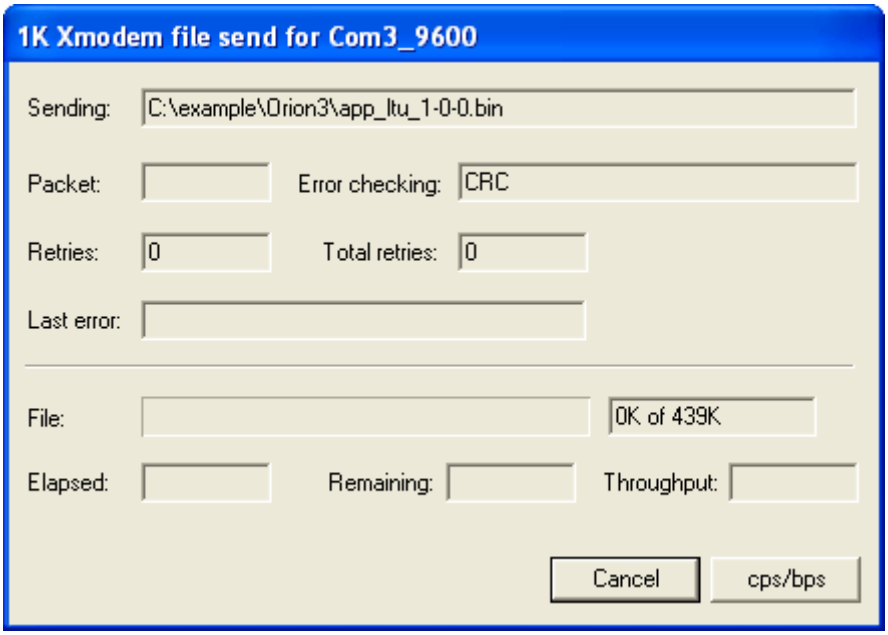
10. Go to the “Fault and maintenance management” menu, means to enter number 2. Enter the <SOFTUPDATE> command. After typing SOFTUPDATE, the device tries to establish connection over the X-modem protocol within 60 seconds.

```
CO_09_FMM>SOFTUPDATE
Flash manufacturer: Silicon Storage Technology(SST)
      Flash device: SST39LF/VF016
     Start address: 0x1000000
        Flash size: 2048 KB
Now upload program via XModem or 1K XModem
C
```

11. The time counter is started. Select Send File in the “Transfer” menu.

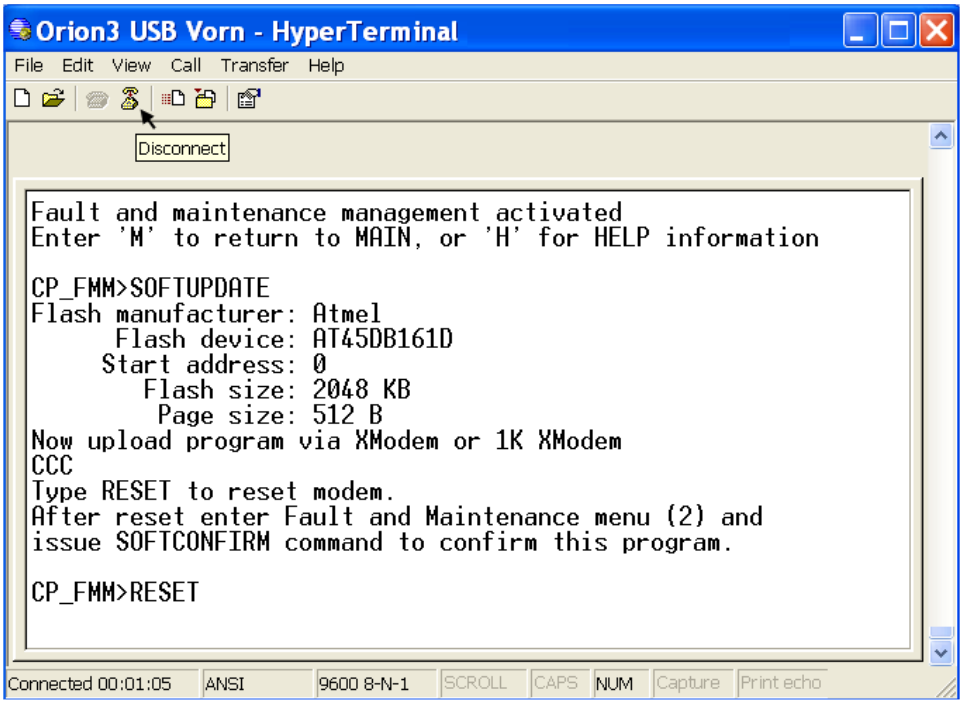


12. Select 1K-Xmodem in the “Protocol” drop-down menu of the “Send File” window. Browse the app.bin file in the “Filename” field (the name of the file depends on the software version). Click “Send”. The Hyper Terminal starts downloading the file. After the download is fully completed, the device stores the downloaded file into the memory. After the Send button is clicked, the “1K-Xmodem file send for…” window pops up.

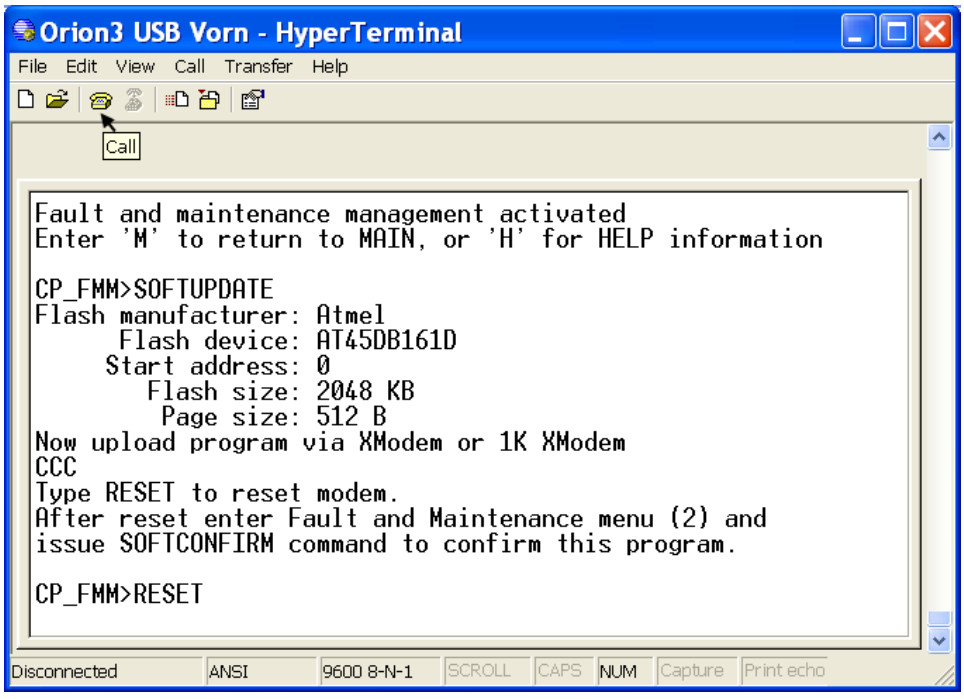


The window displays the software downloading statistics (the name of the file, the number of transmitted packets, the error checking method, the last error, the downloading progress, time, etc.). To cancel downloading, click Cancel.

13. If the software is downloaded, the “1K Xmodem file send for...” window closes automatically.
14. After the software is downloaded completely, enter the <RESET> command in the “Fault and maintenance management” menu. For some computers it is better to disconnect (with the “Disconnect Icon”) the USB interface after the <RESET> command was used, because sometimes the driver does not start correct after this procedure. The disconnect should be done within 10 seconds after the <RESET> command.



After again around 10 seconds (when the modem started again) connect the USB interface again with the “Connect Icon”.



After this, enter the main menu again. Enter the “Fault and maintenance management” menu and input the <SOFTCONFIRM> command.

15. The software downloading is now completed.

7.2 Software Download via Ethernet (1K-Xmodem and Telnet)

This method of the software downloading is similar to the “Software Download via the USB Port (LCT) Using Xmodem Protocol” described in chapter 7.1. The only difference is that instead of selecting the number of the COM port, select TCP/IP Socket. Select 23 for the port number (TELNET). This method is the fastest one, because of the high data rate for downloading.

8 SERVICE INSTRUCTIONS

8.1 General Requirements

- Before unpacking, check if the packing box is intact and if the equipment model is equal to that specified in the purchase order/contract.
- Before running the device, read carefully the present technical description and service instructions. Take care about all Warnings inside this manual! Remember that the guarantee and the free-of-charge repair will not be granted under the following conditions:
  a) If the device or any of its parts fails due to improper installation, testing or operation.
  b) damages resulting from:
  1) Misuse and improper installation, including but not limited to:
  - to use the product for its normal purpose or in accordance with the all the instructions for the proper use and maintenance,
  - installation and use of the product in a conflicting way with the actual technical or safety standards in the country where it is installed, as well as the connection of the device to any other power supply source, that fulfil the required technical or safety standards.
  2) Maintenance or repair performed by unauthorized service centers and dealers.
  3) Operation of a malfunctioning device.
  4) Accidents, lightning strokes, flooding, water, fire, improper ventilation, voltage drops, ingress of moisture and insects inside the equipment as well as other reasons, for example, electromagnetic and other interferences which are beyond the supplier control and do not correspond to specified technical conditions.
  5) Transportation except when the shipping is performed by an authorized dealer or a service center.
  7) Defects of the system into which this product is included.
- If the equipment should be powered from a primary DC source (18 … 72 V), please us it with the grounded “+”.
- Environment requirements: Temperature: from -5 to +45 ℃; Relative air humidity: from 5% to 85% at +25 ℃. Exceptions are units that are specified from the manufacturer to differ from these requirements, because there is a special application.
- It is strictly prohibited:
  a) to alter, delete, remove or make illegible the serial number of the device.
  b) to adapt, adjust and change the equipment in order to improve it or extend its applications without the prior written consent of the manufacturer.
  c) to alter or to adjust the equipment without the consent of the manufacturer.

8.2 Evaluation of the SHDSL Channel Quality and Operation Parameters

The digital channel quality is evaluated by:

- The ITU-T Rec. G.826 error performance (G826) monitoring of a SHDSL link is performed according to ITU-T Rec. G.704, based on CRC (Cyclic Redundancy Check) error detection. Six CRC6 check bits are generated per SHDSL frame. CRC6 errors are used by the software to count the block errors of the SHDSL channel.
- The Noise Margin (NM) performance monitoring.

The Noise Margin (NM) provides qualitative performance information of a specific SHDSL link according the ITU-T Rec. G.991.2. The <NM> command is used to show the noise margin. The recommended NM values should be no less than 6 dB. This value provides the necessary reserve of the signal/noise margin. It is recommended to perform the Noise Margin performance monitoring during acceptance tests and in case the system operates not stable. The test is also used to locate any damaged cable segment.

9 APPENDICES

9.1 Quick Installation Guide for FlexDSL MiniFlex

9.1.1 Enter a FlexDSL MiniFlex

To enter in a MiniFlex subrack unit, use the Local Craft Terminal (USB) interface with Hyper Terminal (or any equal program) or go with Telnet through the Ethernet interface.

Local Craft Terminal (USB) Interface (this must be done on Switch and every SHDSL line card):

- Configure the COM port: Bits per second:9600, Data bits: 8, Parity: None, Stop bits: 1, Flow control: None.
- Press <ENTER>.

Telnet through Ethernet Interface:

- Type in command line <Telnet 192.168.0.235> and press <ENTER>. This is the default Ethernet Address for the Switch in a MiniFlex. All SHDSL line cards have next Ethernet Addresses: Slot1-IP_192.168.0.236 until Slot10-IP_192.168.0.245

After a successful entering the main menu of each device will be displayed. If you enter on Switch, the Switch menu will be displayed, if you enter a SHDSL line card, the line card menu will be displayed.

9.1.2 Configure a FlexDSL MiniFlex

A first installation example with the most important commands and points to care about is shown below. We just like to have an Ethernet transmission between the two MiniFlex devices over 2 SHDSL copper pairs with a speed of 22.8Mbit/s. The pairs should aggregate (bundle) the data traffic and in case of any SHDSL pair failure, the remaining pair should continue to work.

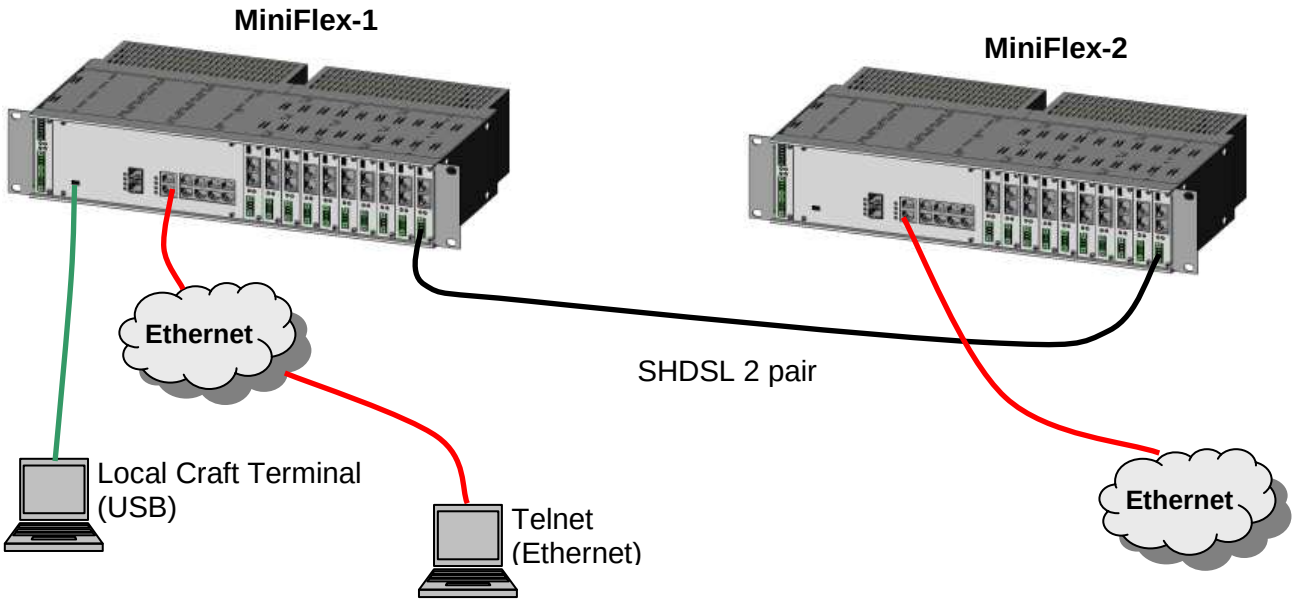


Figure 9.1 Application Example to connect two MiniFlex

MiniFlex-1, Slot10, SHDSL line card: Enter the line card with the LCT (USB) or Telnet interface (IP Address 192.168.0.245).

Type following commands	Description
3 <↵>	Go to Configuration Management (CM)
<DEFAULT EVERYTHING> <↵>	Set everything to default configuration
<MASTER ON 1> <↵>	Configure SHDSL 1 as MASTER
<MASTER ON 2> <↵>	Configure SHDSL 2 as MASTER
<PAYLOAD WAN 1> <↵>	Configure Ethernet over SHDSL 1
<PAYLOAD WAN 2> <↵>	Configure Ethernet over SHDSL 2
<NET> <↵>	Go to NET menu
<SETIP 10.0.2.200> <↵>	Set the IP-address of the device
<NETMASK 255.0.0.0> <↵>	Set the subnet mask
<GATEWAY 10.0.0.101> <↵>	Set the default gateway
<M> <↵>	Go to Configuration Management (CM)
<M> <↵>	Go to Main Menu
2 <↵>	Go to Fault and maintenance management (FMM)
<APPLY ALL> <↵>	Apply all configurations (written in the running config.)
<CONFIRM> <↵>	Confirm all configurations (written in the startup config.)

In Menu Configuration Management (CM) you can type <CONFIG> to see the following picture:

```
CO_CM>CONFIG
--------------------------------------------------------------------------------

Running Line Configuration

--------------------------------------------------------------------------------

xDSL               DSL1          DSL2
  Mode          :  Master(HTU-C) Master(HTU-C)
  Extended rates:  OFF           OFF
  Line coding   :  PAM32         PAM32
  Baserate      :  89            89
  Annex         :  B             B
  Payload       :  WAN           WAN
  Clock source  :  Int           Int
  GS compatible :  OFF
--------------------------------------------------------------------------------

CO_CM>
```

MiniFlex-1, Switch card:

Default IP address of MiniFlex Switch is 192.168.0.235; all ports of it are combined in default VLAN. We need to change IP address to prevent address duplication. In MiniFlex switch menu type following commands:

Type following commands	Description
<EN><↵>	Go to privileged mode (login and password are admin)
<IP 10.0.1.1/8 GATEWAY 10.0.0.101><↵>	Enter IP address, Network Mask and default gateway
<SAVE CONFIGURATION><↵>	Save configuration

MiniFlex-2, Slot10, SHDSL line card: Enter the line card with the LCT (USB) or Telnet interface (IP Address 192.168.0.245).

Type following commands	Description
3 <↵>	Go to Configuration Management (CM)
<DEFAULT EVERYTHING> <↵>	Set everything to default configuration
<MASTER OFF 1> <↵>	Configure SHDSL 1 as SLAVE
<MASTER OFF 2> <↵>	Configure SHDSL 2 as SLAVE
<PAYLOAD WAN 1> <↵>	Configure Ethernet over SHDSL 1
<PAYLOAD WAN 2> <↵>	Configure Ethernet over SHDSL 2
<NET> <↵>	Go to NET menu
<SETIP 10.0.2.201> <↵>	Set the IP-address of the device
<NETMASK 255.0.0.0> <↵>	Set the subnet mask
<GATEWAY 10.0.0.101> <↵>	Set the default gateway
<M> <↵>	Go to Configuration Management (CM)
<M> <↵>	Go to Main Menu
2 <↵>	Go to Fault and maintenance management (FMM)
<APPLY ALL> <↵>	Apply all configurations (written in the running config.)
<CONFIRM> <↵>	Confirm all configurations (written in the startup config.)

In Menu Configuration Management (CM) you can type <CONFIG> to see the following picture:

```
CP_CM>CONFIG
--------------------------------------------------------------------------------

Running Line Configuration

--------------------------------------------------------------------------------

xDSL                DSL1          DSL2
  Mode          :   Slave(HTU-R)  Slave(HTU-R)
  Extended rates:   OFF           OFF
  Line coding   :   PAM32         PAM32
  Baserate      :   89            89
  Annex         :   B             B
  Payload       :   WAN           WAN
  Clock source  :   Int           Int
  GS compatible :   OFF
--------------------------------------------------------------------------------

CP_CM>
```

The idea is the following: the default settings help any device to be in an initial state, then the MASTER/SLAVE mode is enabled on the modem, then the transmit data is configured, then the network settings are configured (IP address, default subnet mask and default gateway) and finally, these settings are applied and then are written in the EEPROM.

ATTENTION

DON'T FORGET TO WRITE THE CONFIGURATION IN THE STARTUP CONFIGURATION WITH THE FOLLOWING COMMANDS:

2 <↵>	Go to Fault and maintenance management (FMM)
<APPLY ALL> <↵>	Apply all configurations (written in the running config.)
<CONFIRM> <↵>	Confirm all configurations (written in the startup config.)

MiniFlex-2, Switch card:

Default IP address of MiniFlex Switch is 192.168.0.235; all ports of it are combined in default VLAN. We need to change IP address to prevent address duplication. In MiniFlex switch menu type following commands:

Type following commands	Description
<EN><↵>	Go to privileged mode (login and password are admin)
<IP 10.0.1.2/8 GATEWAY 10.0.0.101><↵>	Enter IP address, Network Mask and default gateway
<SAVE CONFIGURATION><↵>	Save configuration

9.1.3 Checking of Correct Working

On every SHDSL line card you have to check the noise margin of the DSL line! The noise margin (NM) provides qualitative performance information of a specific SHDSL link according the ITU-T Rec. G.991.2. Perform the next commands to check the status of every line card.

Type following commands	Description
2 <↵>	Go to Fault and maintenance management (FMM)
<STATUS> <↵>	Displays the actual system status

```
CO_FMM>STATUS
-------------------------------------------------------------------------
Status                 :       DSL1       DSL2
-------------------------------------------------------------------------
I/F mode               :         CO         CO
SYNC                   :          1          1
SEGD                   :          1          1
Power backoff          :        0.0        0.0                      dbm
Far end power backoff  :        0.0        0.0                      dbm
Loop attenuation       :       14.0       14.0                      dB
NMR                    :        7.0        7.0                      dB
Bitrate                :       5704       5704                      kbit/s
SRU #                  :          0          0
Active sync. source    :   Internal   Internal
-------------------------------------------------------------------------
Temperature            :   39.750 C
-------------------------------------------------------------------------

CO_FMM>
```

ATTENTION
THE RECOMMENDED NM VALUE FOR A STABLE SHDSL CONNECTION IS > 6DB. AFTER INSTALLATION AND ANY CHANGE OF THE CONFIGURATION THIS VALUE SHOULD BE CHECKED.

9.1.4 Problem with FlexDSL MiniFlex

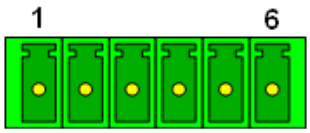
In case you have any trouble with the FlexDSL MiniFlex device, please send following details to your FlexDSL contact:

- Application Description
- Main Menu Picture of every device (Switch and SHDSL line cards)
- Configuration of every device (Please perform with the <DUMP> command

9.2 Connector Description

9.2.1 Alarm Connector (ALARM)

Type – Phoenix Mini Combicom MC 1,5/6-G-3,5 (female), 6 pins.

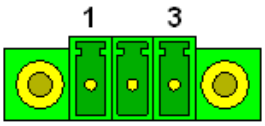


Pin No.	Description
1	Non Urgent Alarm, Common Contact
2	Non Urgent Alarm, Normally Closed
3	Non Urgent Alarm, Normally Open
4	Urgent Alarm, Common Contact
5	Urgent Alarm, Normally Closed
6	Urgent Alarm, Normally Open

Matching Type for the cable: MC1,5/6-ST-3,5
For AWG 16-28
Area 0.08–1.5 mm^2 or Diameter 0.32-1.4 mm

9.2.2 DC Power Connector (DC1, DC2)

Type – Phoenix Mini Combicom MC 1,5/3-GF-3,5 (female), 3 pins.

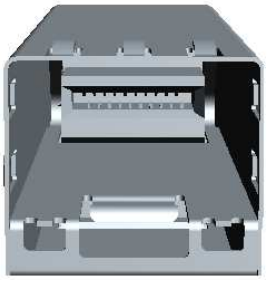


Pin No.	Description
1	-PWR (Negative power supply terminal)
2	FPE, GND (Functional Protective Earth / GND)
3	+PWR (Positive power supply terminal)

Matching Type for the cable: MC1,5/3-STF-3,5
For AWG 16-28
Area 0.08–1.5 mm^2 or Diameter 0.32-1.4 mm

9.2.3 Gigabit Ethernet SFP Connector (P1, P2) & 100Mbps SFP FOM and Serial

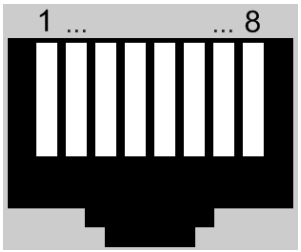
Type – 2x SFP Tyco 1658391-1.



Pin No.	Signal	Description
1,17,20	TGND	transmit ground
2	TxFault	Transmit fault indication
3	TxDisable	transmit disable
4	MOD-DEF(2)	SDA line (I2C)
5	MOD-DEF(1)	SCL line (I2C)
6	MOD-DEF(0)	Module absent
7	RateSelect	rate select
8	LOS	Loss of signal indication
9,10,11,15	RGND	receive ground
12	RD-	receive data -
13	RD+	receive data +
15	RX_VCC	receive VCC
16	TX_VCC	transmit VCC
18	TD+	transmit data +
19	TD-	transmit data -

9.2.4 Gigabit Ethernet Connector (P3, P4)

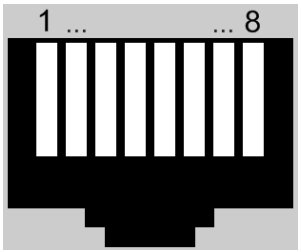
Type – RJ-45 (female), 8 pins.



Pin No.	Description
1	Bi-directional pair A+
2	Bi-directional pair A-
3	Bi-directional pair B+
4	Bi-directional pair C+
5	Bi-directional pair C-
6	Bi-directional pair B-
7	Bi-directional pair D+
8	Bi-directional pair D-

9.2.5 10/100Mbps Ethernet Connector (P5-P12)

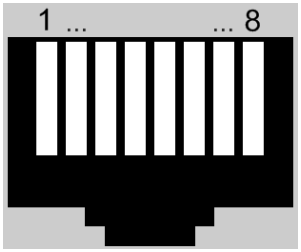
Type – RJ-45 (female), 8 pins.



Pin No.	Description
1	Tx+ (transmit data)
2	Tx- (transmit data)
3	Rx+ (receive data)
4	NC (not used)
5	NC (not used)
6	Rx- (receive data)
7	NC (not used)
8	NC (not used)

9.2.6 SHDSL, FOM, Switch and Serial Line Card & DINrail Ethernet Connector

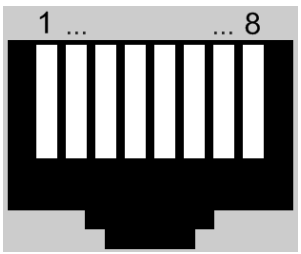
Type – RJ-45 (female), 8 pins.



Pin No.	Description
1	Tx+ (transmit data)
2	Tx- (transmit data)
3	Rx+ (receive data)
4	NC (not used)
5	NC (not used)
6	Rx- (receive data)
7	NC (not used)
8	NC (not used)

9.2.7 POE Line Card Ethernet Connector

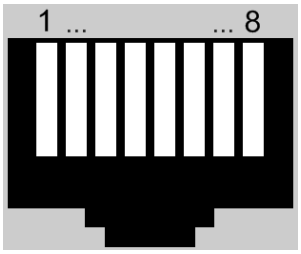
Type – RJ-45 (female), 8 pins.



Pin No.	Description	PoE, MDI Mode A	PoE, MDI Mode B
1	Tx+ (transmit data), PoE	+	
2	Tx- (transmit data), PoE	+	
3	Rx+ (receive data), PoE	-	
4	NC (not used), PoE		+
5	NC (not used), PoE		+
6	Rx- (receive data), PoE	-	
7	NC (not used), PoE		-
8	NC (not used), PoE		-

9.2.8 Serial RS-232 & RS-232/422/485 Line Card & Dinrail Serial Interface Connector

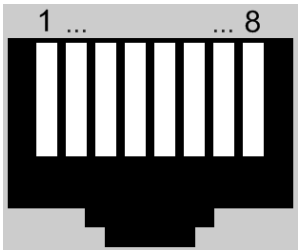
Type – RJ-45 (female), 8 pins.



Pin No.	Description RS-232	In-, Output
1	TxD (transmit data)	Output
2	RTS (request to send)	Output
3	RxD (receive data)	Input
4	GND (Ground)	
5	GND (Ground)	
6	CTS (clear to send)	Input
7	CC (cable connected)	
8	GND (Ground)	

To detect the cable as connected, connect the CC to GND.

Type – RJ-45 (female), 8 pins.

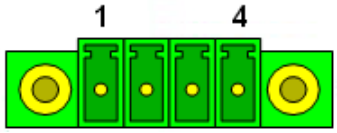


Pin No.	Description RS-422/485	In-, Output
1	Tx+ (transmit data)	Output
2	Tx- (transmit data)	Output
3	Rx+ (receive data)	Input
4	GND (Ground)	
5	GND (Ground)	
6	Rx- (receive data)	Input
7	CC (cable connected)	
8	GND (Ground)	

To detect the cable as connected, connect the CC to GND.

9.2.9 SHDSL Line Card &DINrail xDSL Connector

Type – Phoenix Mini Combicom MC 1,5/4-GF-3,5 (female), 4 pins.



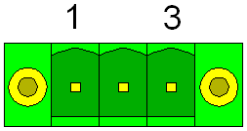
Pin No.	Description
1	SHDSL interface A
2	SHDSL interface A
3	SHDSL interface B
4	SHDSL interface B

Matching Type for the cable: MC1,5/4-STF-3,5
For AWG 16-28, Screw
Area 0.08–1.5 mm^2 or Diameter 0.32-1.4 mm

Or: FK-MCP 1,5/ 4-STF-3,5
For AWG 16-26, Push-in
Area 0.14–1.5 mm^2 or Diameter 0.4-1.4 mm

9.2.10 DINrail Power Connector

Type – Phoenix Combicom MSTB 2,5/ 3-GF-5,08(male), 3 pins..



Pin No.	Description
1	-PWR Negative power terminal or N (Neutral power terminal)
2	FPE, GND (Functional Protective Earth / GND)
3	+PWR Positive power terminal or L (Life power terminal)

Matching Type for cable: FKCT 2,5/ 3-STF-5.08
For AWG 12-24
Area 0.2–2.5 mm^2 or Diameter 0.5-1.75 mm

9.2.11 Local Craft Terminal (USB) Connector (LCT)

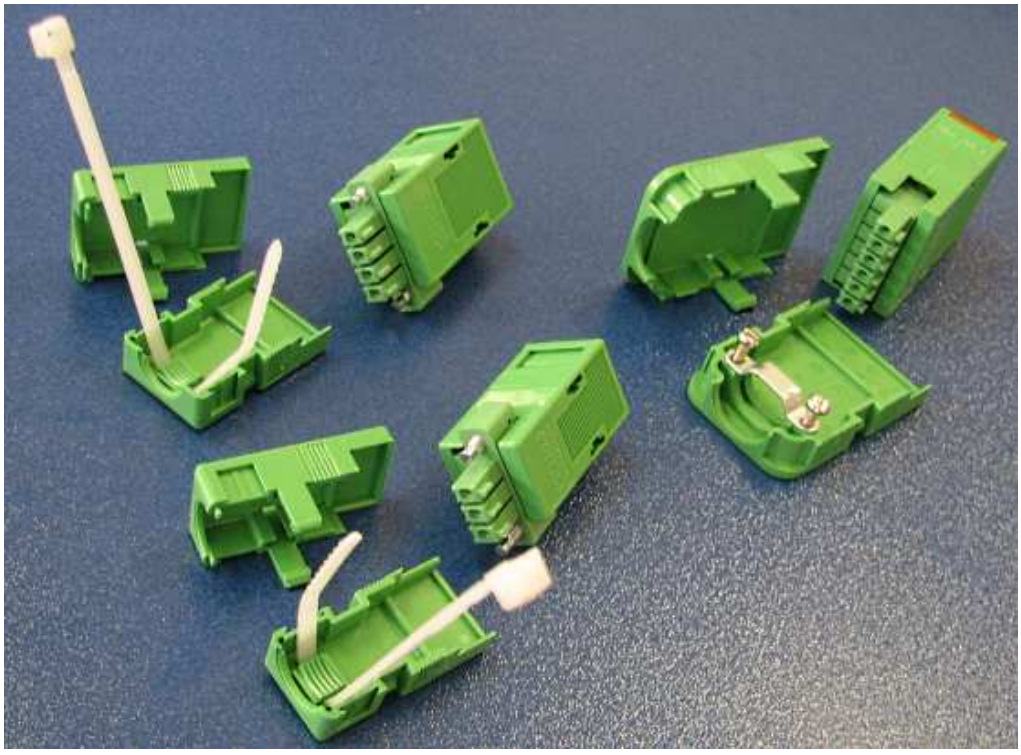
Type – USB Type Mini-B (female, receptacle), 5 pins.

Pin No.	Signal	Description
1	VCC	+5V
2	D-	Data -
3	D+	Data +
4	NC	
5	GND	SGND

9.2.12 Connector Hoods and Cord Retaining

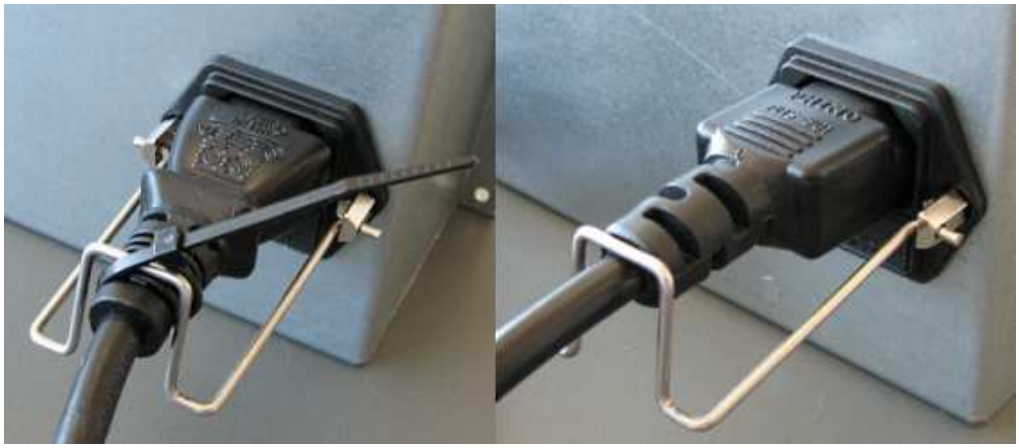
For the Phoenix Mini Combicom connector series, there are some hoods available.

Connector	**Matching Cable Housing**
MC1,5/3-STF-3,5	KGG-MC-1,5/3
MC1,5/4-STF-3,5	KGG-MC-1,5/4
MC1,5/6-ST-3,5	KGG-MC-1,5/6



For the power supply connector on the back of MiniFlex, there is a cable cord retaining kit available.

Connector	**Cord Retaining Kit**
AC Power	4700.0002



These items, if needed, must be ordered separately!

10 TECHNICAL SPECIFICATION

10.1 Interfaces

10.1.1 1000Base-X Gigabit Ethernet (P1, P2)

Standard:	IEEE-802.3, VLAN IEEE-802.1Q, QoS IEEE-802.1P
Data Rate	1000Base-X, Full/Half Duplex
Protocols	Data, Telnet, SNMP
Connector Type	SFP

Recommended 1.25Gbps SFP Transceiver (1000Base-LX interface):

- EOLS 1312-10D
- HSFP-24-3311S-22F

10.1.2 1000Base-T, Gigabit Ethernet (P3, P4)

Standard:	IEEE-802.3, VLAN IEEE-802.1Q, QoS IEEE-802.1P
Data Rate	1000Base-T, Full/Half Duplex
Protocols	Data, Telnet, SNMP
Signal Level	Ethernet
MDI / MDI-X auto crossover	Supported
Auto Negotiation	Supported
Connector Type	RJ45, 8 pin

10.1.3 10/100Base-T Ethernet (P5-P12, SHDSL, FOM, POE, Serial and Switch)

Standard:	IEEE-802.3, VLAN IEEE-802.1Q, QoS IEEE-802.1P
Standard if POE	IEEE 802.3af (15.4W) or IEEE 802.3at (40.0W)
Data Rate	10/100Base-T, Full/Half Duplex
Protocols	Data, Telnet, SNMP, WEB
Signal Level	Ethernet
MDI / MDI-X auto crossover	Supported
Auto Negotiation	Supported
Connector Type	RJ45, 8 pin

10.1.4 SHDSL Line Interface

Specification	ITU-T G.991.2-G.shdsl, ITU-T G.991.2-G.shdsl.bis
Line Code	TC-PAM16/32, Extended: TC-PAM4/8/64/128
Impedance	135Ω
Transmit Power	13.5 (Annex A) or 14.5 (Annex B) dBm @ 135Ω
Number of Pairs	1 or 2
Bit Rate	192 to 5704kbit/s, Extended: 128 to 15232kbit/s
Connector Type	Phoenix Mini Combicom 4 pin: MC 1,5/4-GF-3,5
Overvoltage Protection	ITU-T Rec. K.20/K.21

10.1.5 100Base-FX Ethernet (FOM, Serial RS-232 Interface)

Standard:	IEEE-802.3, VLAN IEEE-802.1Q, QoS IEEE-802.1P
Data Rate	100Base-TX, Full/Half Duplex
Protocols	Data, Telnet, SNMP, WEB
Connector Type	SFP

Recommended 155Mbps SFP Transceiver (Fast Ethernet, OC-3, STM-1):

- LS38-A3S-TC-N
- XGSF-03-1503-80

10.1.6 Serial Interface RS-232/422/485 (Serial RS-232 / RS-232/422/485 Interface)

Standard:	ITU-T Rec V.28 or RS-232/485
Bit Rate	75, 150, 300, 600, 1200, 2400, 4800, 9600, 14400,
MF-FOM-RAIL2N-SER-xx	19200, 28800, 38400, 56000, 57600, 115200, 230400
MF-FOM-SR2L-SER/Eth,Vx	bps
Bit Rate	75, 1200, 2400, 9600, 19200, 38400, 57600, 115200,
MF-FOM-RAIL2N-2V24-xx	230400 bps
MF-SER-SRL-4V24,Vx	
Format RS-232/485	Bits: 5…8
	Stop bits: 1/1.5/2
	Parity: odd/even/mark/space
Connector Type	RJ45, 8 pin

10.1.7 Local Craft Terminal (USB) Interface

Specification	USB V2.0 full and low speed
Data Rate	12Mbit/s
Protocol	Master/Slave, Uses the USB communication device class (CDC) drivers to take advantage of the installed PC RS-232 software to talk over the USB
Connector Type	USB Type Mini-B female connector

10.1.8 Alarm Interface

Specification	Isolated Relay Output
Load	1A @ 24VDC, 0.5A @ 125VAC
Max. Operation Voltage	60VDC, 125VAC
Max. Operation Current	1A
Max. Switch Capacity	62VA, 30W
Connector Type	Phoenix Mini Combicom 6 pin: MC 1,5/6-G-3,5

10.2 Power Supply

10.2.1 MiniFlex Mini DSLAM (Subrack)

Specification	ETSI ETS 300 132-2
MF-PS48, V1	
Input Voltage	18-72VDC
Connector Type	Phoenix Mini Combicom 3 pin: MC 1,5/3-GF-3,5
MF-PS110/230, V1	
Input Voltage	90-264VAC, 47-63Hz
Connector Type	IEC 60320-1, C14, 10A/250VAC
	UL 498, CSA C22.2 no. 42
Power Consumption	Max. 18W for MiniFlex without SHDSL Line Cards
(All DSL links up, Ethernet on)	Max. 4.0W for MF-PAM-SR2L-2Eth,V1
	Max. 2.2W for MF-FOM-SRL,V1
	Max. 3.7W for MF-FOM-SR2L-2Eth,V1
	Max. 3.8W for MF-FOM-SR2L-SER/Eth,V1
	Max. 42.0W for MF-POE-SRL-2Eth,V1
	Max. 3.5W for MF-SW-SRL-8Eth,V1
	Max. 2.2W for MF-SER-SRL-4V24,V1

10.2.2 MiniFlex MiniRack

Specification	ETSI ETS 300 132-2
Input Voltage	18-72VDC
Connector Type	Phoenix Mini Combicom 3 pin: MC 1,5/3-GF-3,5
Power Consumption (All DSL links up, Ethernet on)	Typ. 16W for MiniRack with SHDSL Line Cards

10.2.3 MiniFlex DINrail

Specification	ETSI ETS 300 132-2
-12V Models	
Input Voltage	9-18VDC
Connector Type	Phoenix Combicom 3 pin: MSTB 2,5/ 3-GF-5,08(male)
-24V Models	
Input Voltage	18-72VDC
Connector Type	Phoenix Combicom 3 pin: MSTB 2,5/ 3-GF-5,08(male)
-230V Models	
Input Voltage	85-264VAC, 120-370VDC, 47-63Hz
Connector Type	Phoenix Combicom 3 pin: MSTB 2,5/ 3-GF-5,08(male)
Power Consumption (All DSL links up, Ethernet on)	Max. 4.8W for MF-PAM-RAIL2N-2Eth-12V, V1 Max. 5.3W for MF-PAM-RAIL2N-2Eth-24V, V1 Max. 4.5W for MF-PAM-RAIL2N-2Eth-230V, V1 Max. 3.7W for MF-FOM-RAILN-Eth-24V, V1 Max. 2.7W for MF-FOM-RAILN-Eth-230V, V1 Max. 5.0W for MF-FOM-RAIL2N-2Eth-24V, V1 Max. 4.4W for MF-FOM-RAIL2N-2Eth-230V, V1 Max. 42.0W for MF-POE-RAILN-Eth-24V, V1 Max. 4.1W for MF-SW-RAIL-4Eth-24V, V1 Max. 3.5W for MF-SW-RAIL-4Eth-230V, V1 Max. 5.0W for MF-FOM-RAIL2N-2V24-24V, V1 Max. 4.5W for MF-FOM-RAIL2N-2V24-230V, V1 Max. 5.3W for MF-FOM-RAIL2N-SER/Eth-24V, V1 Max. 4.6W for MF-FOM-RAIL2N-SER/Eth-230V, V1

10.3 Environment

10.3.1 Climatic Conditions

Storage:	ETS 300 019-1-1 Class 1.2	(-25°C … +55°C)
Transportation:	ETS 300 019-1-2 Class 2.3	(-40°C … +70°C)
Operation:	ETS 300 019-1-3 Class 3.2	(-5°C … +45°C)

Higher Operation Temperature range available on request (-25°C … +80°C)

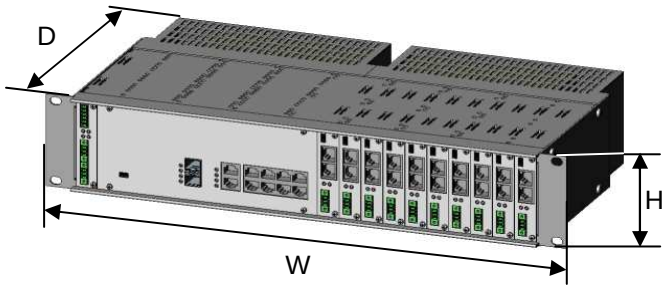
10.3.2 EMC and Safety Standards

EN 300386 V1.4.1:2008	EN 61000-4-2/A2:2001
EN 50121-4:2006	EN 61000-4-3:2006
EN 60950-1:2006	EN 61000-4-4:2004
EN 55022:2006, Class B	EN 61000-4-5:2006
EN 55024/A2:2003	EN 61000-4-6:2007
	EN 61000-4-6/A1:2001

10.4 Physical Dimensions and Weight

10.4.1 MiniFlex Mini DSLAM (Subrack)

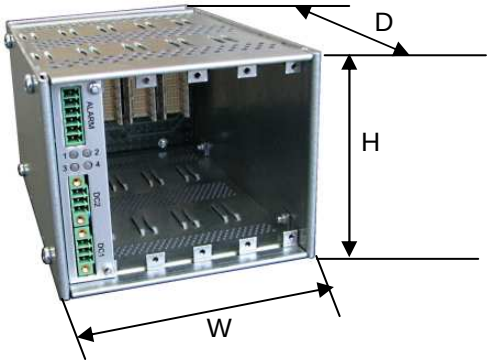
Dimension with Power Supply:
482(W)x248(D)x89(H) mm
19” (W), 2U (H)



Weight without Line Cards	< 4.4kg
Weight with 10 Line Cards	< 5.5kg

10.4.2 MiniFlex MiniRack

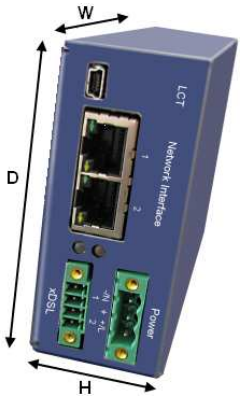
Dimension with Power Supply:
110(W)x181(D)x88(H) mm
with Clip
2U (H)



Weight without Line Cards	< 1.1kg
Weight with 4 Line Cards	< 1.7kg

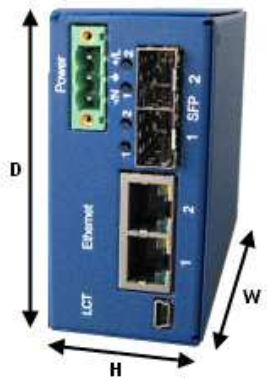
10.4.3 MiniFlex SHDSL, Single FOM, POE DINrail

Dimension:
143(W)x87(D)x37(H) mm
153(W)x87(D)x37(H) mm with Clip



Weight	< 0.5kg in Metal DIN-Rail Enclosure

10.4.4 MiniFlex Dual FOM, Managed Switch, Serial RS-232 Interface DINrail

Dimension: 143(W)x87(D)x43(H) mm 153(W)x87(D)x43(H) mm with Clip	
Weight	< 0.5kg in Metal DIN-Rail Enclosure